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GAHAN (A. B.). **Some Synonymy and new Combinations in Chalcidoidea (Hymenoptera).**—*Canad. Ent.* **83** no. 7 pp. 170–176. Ottawa, 1951.

Notes are given on the synonymy and generic assignment of some 20 Chalcidoids ; synonymy that affects species that have been mentioned in this *Review* includes *Prodecatoma cooki* (How.) (*phytophaga* Crosby), *Tetrastichus tineivorus* Ferrière (*carpatus* Burks) and *Catolaccus hunteri* (Crwf.) (*townsendi* (Crwf.)) [*cf. R.A.E.*, A **37** 286]. *Chiloneurinus* is made a synonym of *Apterencyrtus*, the type of the latter (*A. pulchricornis* Ashm.), which was described from an apparently damaged female, being in the author's opinion a synonym of that of the former (*Cheiloneurus microphagus* Mayr).

WEBB (F. E.) & FORBES (R. S.). **Notes on the Biology of** *Pleroneura borealis* **Felt (Xyelidae : Hymenoptera).**—*Canad. Ent.* **83** no. 7 pp. 181–183, 1 fig., 3 refs. Ottawa, 1951.

In 1945, shoots of *Abies balsamea* in New Brunswick were commonly injured by sawfly larvae tentatively identified as *Pleroneura borealis* Felt, and similar injury has since been observed throughout most of New Brunswick, eastern Nova Scotia, the northern peninsula of Michigan and northern Wisconsin. The sawfly was also found on planted *Abies concolor*. Observations on its bionomics in field and laboratory were made over a period of two years in New Brunswick. Under cage conditions, only four of about 1,000 field-collected larvae completed their development. In the rearing method finally adopted, larvae were allowed to drop from infested twigs on to sheets of paper, from which they were transferred to screened boxes filled with sifted soil ; these were kept out of doors in shallow trenches covered with litter during the winter and transferred to large cages in spring. Adults were found on buds of *A. balsamea* only between 25th and 28th May. Caged individuals paired readily and eggs were seen on 2nd June, but oviposition probably began earlier, since young larvae were found on 29th May. The eggs were deposited singly in the needle clusters shortly after the bud scales dropped, and their presence was indicated by a slight browning of the needles. Not more than one was laid per shoot. The larvae mined downwards in the shoots, which they entered near the tip, and were observed feeding between 29th May and 23rd June. When fully fed, they dropped to the ground and entered the soil, where winter was passed in the larval or pupal stage within an earthen cell. There was only one generation a year.

Trees about 6 ft. high were the most readily attacked, especially those in the open. Infestation was heaviest on new shoots on whorls 2–4 years of age ; the main shoots of fast-growing trees in the open were not attacked, and those of trees in the shade were rarely infested. The needles on an infested shoot turn red, and the shoot generally drops after the larva has left it. Although damage is common and new foliage is attacked, the trees are not seriously injured. A species of *Ephialtes* (*Scambus*) close to *hispae* (Harr.) was the only parasite reared from *P. borealis*.

REEKS (W. A.) & BARTER (G. W.). **Growth Reduction and Mortality of Spruce caused by the European Spruce Sawfly,** *Gilpinia hercyniae* **(Htg.) (Hymenoptera : Diprionidae).**—*For. Chron.* **27** no. 2 repr. 16 pp., 4 figs., 18 refs. Toronto, 1951.

During the severe outbreak of *Gilpinia hercyniae* (Htg.) on spruce (*Picea*) in eastern Canada that was first reported in 1930 and ended about ten years later [*cf. R.A.E.*, A **20** 590 ; **33** 398], heavy tree mortality occurred only in

the Gaspé Peninsula, where the outbreak lasted for 8–15 years in some stands and was accompanied by an outbreak of *Dendroctonus piceaperda* Hopk. during part of the time. In other areas in Quebec and in New Brunswick, the outbreak lasted 4–7 years.

In this paper, the authors describe the characteristics and effects of defoliation of spruce by the sawfly, based on observations in 1932–47, and compare them with those of defoliation by *Choristoneura fumiferana* (Clem.). The following is taken from their summary. Defoliation by the sawfly caused a gradual reduction in the width of the annual ring throughout the stem, and this reduction was greatest in the lower part. The effect of feeding in one year was shown in the ring of the following year, and reduction of growth was proportionate to the rate of growth before attack. Surviving trees showed as many as four completely missing rings in the lower stem as well as several partial rings, but no missing rings in the top. Loss of 20–50 per cent. of the old foliage was necessary to cause measurable reduction in the ring, and loss of all the old foliage and 75 per cent. or more of the new was generally necessary to cause death. Trees continued to die for as many as seven years after defoliation ceased. Total mortality in the Gaspé Peninsula is estimated at about 11,400,000 cords of spruce, and additional loss resulted from reduced growth on surviving trees and associated windfall. In the Cascapedia district, it is estimated that the total volume of white spruce (*P. glauca*) was reduced by about 12·5 cords per acre. The proportion of balsam fir (*Abies balsamea*), by stems, increased from about 70 per cent. in the original stand to about 80 per cent., and balsam fir constituted about 82 per cent. of the reproduction.

WELLINGTON (W. G.). **Variations in the Silk-spinning and Locomotor Activities of Larvae of the Spruce Budworm, *Choristoneura fumiferana* (Clem.), at different Rates of Evaporation.**—*Trans. roy. Soc. Can.* (3) **44** Sec. 5 pp. 89–101, 3 graphs, 11 refs. Ottawa, 1950.

Investigations on the reactions of larvae of *Choristoneura fumiferana* (Clem.) to temperature and moisture have shown that they aggregate primarily in response to rates of evaporation, and that the aggregations are formed at evaporation rates peculiar to each instar [*cf. R.A.E.*, A **38** 341–342]. The first, second and sixth instars proved to be particularly important for dispersal, establishment and survival, and reactions to evaporation rates in these were therefore further studied. The micro-evaporimeter was again used [*cf.* **38** 342], and the temperature in the tests was 20·6°C. [69°F.].

Aggregations stable enough to be valid for inter-instar comparisons were obtained at evaporation rates of 0·09–0·1 cu. mm. per minute for the first instar, 0·13–0·14 for the second and 0·04 for the sixth. The first-instar larvae spin hibernacula without feeding, and it was found that spinning began soonest within the evaporation zone favourable for aggregation. Some larvae began to spin at high rates of evaporation, but the proportion that began at rates near saturation was negligible. The ability of the second-instar larvae to establish themselves in the field depends to some extent on their rapidity of movement, and it was shown that larvae kept at constant rates of evaporation moved most rapidly at the preferred evaporation rates. They had also an orthokinetic response to conditions near saturation, which took the form of a sudden, temporary increase in rate of crawling ; in gradients of moisture, this was associated with a turning reaction. In the field, the sixth instar is the period of heaviest feeding, and there is little movement, and consequent interruption of feeding, unless conditions are unfavourable. Larvae kept at constant rates of evaporation moved about much less within the preferred evaporation zone than at any rates outside it, except at saturation. They were

especially active at rates just above and just below the preferred zone, but this excessive activity diminished rapidly at still higher or lower evaporation rates.

WILLIS (E. R.) & ROTH (L. M.). **Humidity Reactions of *Tribolium castaneum* (Herbst).**—*J. exp. Zool.* **115** no. 3 pp. 561–587, 2 figs., 25 refs. Philadelphia, Pa., 1950.

The following is based on the authors' summary of this paper, in which an account is given of investigations further to those already reported [*R.A.E.*, A **39** 246]. Studies of the humidity reactions of adults of *Tribolium castaneum* (Hbst.) in an improved olfactometer, in which the insects were given a choice between humidities that were presented in pairs in various combinations covering the relative-humidity range, showed that unstarved, non-desiccated beetles discriminated between humidities differing by 15 per cent. relative humidity or more over the entire range. With a choice between humidities that differed by only 5 per cent., they discriminated weakly between 0 and 5 per cent., not at all between 40 and 45 per cent., 45 and 50 per cent. or 50 and 55 per cent., but intensely between 95 and 100 per cent. The intensity of the dry reaction (preference for the lower humidity) of such beetles, when offered alternative humidities between which they could discriminate, was a function of the higher humidity from about 30 to 100 per cent. relative humidity.

The preference for the lower or higher humidity and the intensity of the humidity reaction of beetles given a choice between 15 and 75 per cent. relative humidity were related to the degree of starvation and to their water balance. Among both desiccated and non-desiccated beetles, the preference for the lower humidity decreased in intensity with the period of starvation, but it persisted after two weeks of starvation in non-desiccated beetles, whereas it ceased after three days of starvation in desiccated ones and was followed by an intense preference for the higher humidity after five days; the reaction was again reversed in desiccated beetles by providing access to water for about an hour before testing.

The water content, based on the initial live weight, of adults starved in dry air was a function of the period of starvation, but this relation was not found among beetles starved in very moist air. During starvation, there was an increase in the water content of the tissues, based on the final live weight, relative to solids in both desiccated beetles (for the first three days only) and in those kept in a moist atmosphere.

COOPER (B. A.). **Beekeeping and agricultural Sprays.**—*Yearb. Lincs. Beekeep. Ass.* 1950–51 pp. 17–28. Leadenham, Lincs., 1951.

The author describes, partly from the literature and partly from observations in Lincolnshire, the effects on honey bees of various fertilisers, fungicides, weedkillers and insecticides and discusses methods of preventing injury, including the choice of harmless materials and suitable times for spraying, confining the bees or moving the hives before treatment, and providing drinking water, and the treatment of injured colonies. The insecticides dealt with include lead arsenate, derris, nicotine, oils, dinitro-o-cresol and its salts, DDT, chlordan, benzene hexachloride, toxaphene, hexaethyl tetraphosphate, tetraethyl pyrophosphate and parathion.

SPEYER (E. R.) & PARR (W. J.). **Biology and economic Status of the Tomato Moth (*Diataraxia oleracea* L.) with an Account of Measures devised for its Control in commercial Glasshouses.**—*Misc. Publ. exp. Res. Sta. Cheshunt* no. 2, 26 pp., 6 pls., 6 figs., 47 refs. Cheshunt, Herts. [1948.]

This publication, which is based on literature and on work at Cheshunt, Hertfordshire, mostly carried out since 1940, comprises a review of information

on the importance of *Diataraxia oleracea* (L.) as a pest of tomatos in glasshouses in Britain and the damage caused by it to this crop and to cucumbers and ornamental plants that become temporarily infested in glasshouses, a short account of its life-cycle and distribution, brief descriptions of all stages, and a summary of work on its bionomics and control, much of which has been noticed from other sources [*R.A.E.*, A **31** 176 ; **35** 328 ; **38** 418 ; etc.]. A note on the natural enemies of the moth is appended.

SPEYER (E. R.) & PARR (W. J.). **Animal Pests. I. Tomato Leaf-miner (*Liriomyza solani* Hering).**—*34th Rep. exp. Res. Sta. Cheshunt 1948* pp. 43–51, 2 refs. Cheshunt, Herts., 1949.

The species of *Liriomyza* that mines the leaves of tomato in glasshouses in Britain and the Channel Islands [*cf. R.A.E.*, A **35** 327] has been identified as *L. solani* Hering [*Agromyza solani* Macq., which some consider an earlier name for it, being a nomen nudum], and it now appears that *L. strigata* (Mg.) [*cf.* **35** 327 ; **37** 223 ; **38** 419] has not been found on glasshouse plants in Britain or the Channel Islands. Since, however, larval mines have occasionally been observed in leaves of cucumber and, rarely, of lettuce [**35** 327] in glasshouses in which tomatos are or have been growing and *L. solani* has hitherto been considered to be confined to tomatos and other solanaceous plants, it is still possible that two species may be present.

Observations are recorded on the bionomics of *L. solani* in glasshouses at Cheshunt in 1948. In contrast to previous findings [**35** 327], the oviposition and feeding punctures made by the females were not restricted to the lower surfaces of the cotyledons or the upper surfaces of the rough leaves, though the upper surfaces of the latter were preferred to the lower, and a fair proportion of cotyledons contained two eggs. In cages or in the absence of sufficient plants, several eggs were deposited in a single cotyledon or leaflet. Since the females deposit many eggs but rarely lay more than one or two on each plant, a small number of adults can cause widespread infestation. In May, eggs began to hatch in cages 4–5 days after females had been introduced into them ; the larval stage within the mines lasted 9–11 days, and adults emerged after a further 17 days. In early June, the egg stage lasted 3–4 days. Under cool conditions, development within the puparia lasted 15–60 days ; when pupae that were still alive after some seven weeks were transferred to warmer conditions, they gave rise to adults in 3–12 days. Development was more regular at higher temperatures, but did not occupy less than 15 days. Under cool, dry conditions, most of the pupae gave rise to adults, but the latter were usually unable to emerge from the puparia ; this occurred less frequently in moist soil. The long interval that sometimes elapses between the appearance of larvae when the houses are heated up in December and January and that of the next generation can evidently be attributed to a protracted pupal stage. Larvae parasitised by Braconids of the genera *Pachysema* and *Opius* formed puparia in the normal manner. Under cool conditions, the adult parasites emerged after 13–26 days, though in one case emergence was delayed for 41 days ; some were unable to escape from the puparia. Emergence may therefore occur when few host larvae are available and parasitism be reduced, but a severe infestation at Cheshunt was controlled by these parasites in early June 1948.

In experiments with insecticides, adults that came into contact with a dust containing 5 per cent. DDT became paralysed only after a considerable period, whereas one containing 5 per cent. technical BHC (benzene hexachloride) was much more rapid in action. When these dusts were applied to the leaves of tomato seedlings and plants in pots, the numbers of eggs laid in the leaves and cotyledons were reduced. A similar effect was produced when seedlings

were dusted with an inert powder (kaolin), and it is concluded that a deposit of any powder on the leaf surface may hinder oviposition. There was no reduction in the numbers of eggs laid on plants sprayed with a suspension of 0·04 per cent. DDT, which left a smooth deposit on the leaf surface. The DDT and BHC dusts both rapidly killed adults of *Opius* and *Pachysema* that came in contact with them. Larvae of *L. solani* entered soil that had been dusted with DDT or BHC and pupated ; development of both hosts and parasites within the puparia proceeded normally, and some adults of *L. solani* and the parasites emerged from the soil after passing through a layer of DDT dust on its surface ; no adults emerged from soil dusted with BHC.

Tomatoes. Cultivation, Diseases and Pests.—*Bull. Minist. Agric.* no. 77 (3rd edn.), iii+56 pp., 12 pls., 1 diagr., refs. London, H.M.S.O., 1950. Price 2*s.* 6*d.*

The section on pests in glasshouses (pp. 44–51) in this revised edition of a bulletin on the cultivation of tomatos in Britain resembles that in the previous one [*R.A.E.*, A **37** 223], but the information on their control has been brought up to date by the inclusion of recently developed procedures, and some measures now superseded have been omitted. DDT and BHC (benzene hexachloride) applied by means of pyrotechnic smoke generators have been successfully used against the adults of *Trialeurodes vaporariorum* (Westw.) ; several treatments are required, and this method of application is particularly satisfactory for small glasshouses. The smokes are toxic to the parasite, *Encarsia formosa* Gah. BHC smokes are also effective against Aphids. Suspensions and emulsified solutions of DDT destroy the adults of *T. vaporariorum*, but not the eggs or pupae. The dates now recommended for the application of 5 per cent. DDT dusts against *Diataraxia oleracea* (L.) are ten days before the removal of the plants from the propagating houses and again one month later ; the dust is also effective against *Erythroneura pallidifrons* (Edw.). For the control of *Liriomyza solani* Hering [see preceding abstract] in propagating houses, pyrethrum dusts are of some value. Sprays containing 0·08 per cent. BHC kill a high proportion of the larvae in their mines and do not injure the plants. Dusts and sprays applied later in the season, especially those containing DDT, have little effect on the adults and destroy parasites. Applications of BHC have shown promise when used in spring against *Scutigerella immaculata* (Newp.), which is then in the upper layers of the soil.

Armstrong (G.), Bradbury (F. R.) & Standen (H.). **The Penetration of the Insect Cuticle by Isomers of Benzene Hexachloride.**—*Ann. appl. Biol.* **38** no. 3 pp. 555–566, 1 fig., 8 refs. London, 1951.

The following is almost entirely the authors' summary. The penetration of the α, β, γ and δ isomers of benzene hexachloride through the insect cuticle was studied by a micro-colorimetric technique. Adults of *Calandra granaria* (L.) were exposed for varying periods to deposits of 11 mmg. per sq. cm. of the pure isomers on filter paper. The amounts of each isomer picked up by the insects were determined as two fractions, one " outside ", representing that which could be removed by cold methanol washing, and the other " inside ", recovered after decomposing the insects with nitric acid. The results showed that the amounts of the isomers taken up " outside " by the insects in 7–12 hours (12, 3, 60 and 102 mmg. per gm. insect, respectively) are in the approximate ratio of their solubilities in hydrocarbon solvents, and that the γ isomer penetrates through the outer layers of the insect integument much more rapidly than the other three isomers tested. On the basis of these results it is concluded that the first stage of pick-up of insecticide by the insects is simple

solution of the insecticide in the outer waxy covering of the epicuticle and that structural effects play an important part in the penetration through the insect cuticle as well as in toxic effects at the site of action.

McIntosh (A. H.). **Particle Size of insecticidal Suspensions and their Contact Toxicity. III. Temperature Coefficients and Tests by Injection.**—*Ann. appl. Biol.* **38** no. 3 pp. 567–576, 4 figs., 11 refs. London, 1951.

The following is largely the author's summary of this third paper of a series [*cf. R.A.E.*, A **37** 263 ; **38** 232]. The relative toxicities of aqueous suspensions of DDT containing particles of different sizes used in dipping tests against adults of *Oryzaephilus surinamensis* (L.) and *Tribolium castaneum* (Hbst.) differed according to the temperature at which the insects were kept after treatment. Over the range 12–30°C. [53·6–86°F.], the toxicity of colloidal DDT decreased considerably with increasing temperature, whereas that of a suspension of crystals 400 μ in diameter decreased slightly in the case of *T. castaneum* and to a negligible extent in that of *O. surinamensis*. Thus, although a suspension of crystalline DDT was more toxic than colloidal DDT to warm insects, it was less toxic than the colloid to cool insects.

Rotenone suspensions were tested against adults of *Oncopeltus fasciatus* (Dall.) by application of measured droplets under the wings. Colloidal rotenone was more toxic than a crystalline suspension. The bugs could not be killed in this way by DDT suspensions. Tests were also made by injecting suspensions of rotenone, DDT and fluoro-DDT into adults of *O. fasciatus*. A suspension of rotenone crystals was equitoxic with colloidal rotenone against insects kept for two days at 27°C. [80·6°F.] after treatment. The same was true of crystalline and colloidal DDT suspensions. When the bugs were kept at 10°C. [50°F.], colloidal rotenone was much more toxic than crystalline rotenone two days after treatment, but if they were kept for about three weeks and inspected at intervals, the first apparent difference in toxicity grew smaller and in the end nearly disappeared. With DDT, this occurred after about ten days. Suspensions of colloidal and crystalline fluoro-DDT were equitoxic after only two days, even at 10°C.

In the application test, the difference between colloidal and crystalline rotenone was a real difference in toxicity, and did not disappear with the lapse of time ; in the injection tests, the two forms of each poison differed only in speed of action, and not in ultimate toxicity.

Broadbent (L.) & Hollings (M.). **The Influence of Heat on some Aphids.**—*Ann. appl. Biol.* **38** no. 3 pp. 577–581, 2 figs., 6 refs. London, 1951.

The following is very largely the authors' summary. The thermal death-points (temperatures at which some mortality occurred during exposure for one hour at 60 per cent. relative humidity) of Aphids from greenhouse-reared stocks of *Macrosiphum* (*Aulacorthum*) *solani* (Kalt.), *M.* (*Acyrthosiphon*) *pisum* (Harris) (*onobrychis* (Boy.), *pisi* (Kalt.)), *M. solanifolii* (Ashm.) (*euphorbiae*, auct.), *Myzus persicae* (Sulz.) and *Brevicoryne brassicae* (L.) taken directly from their food-plants lay between 38 and 41°C. [100·4 and 105·8°F.]. Many Aphids alive after exposure for one hour to high temperature died within the next day ; no examples of *M. persicae* recovered and reproduced after one hour at temperatures above 37·5°C. [99·5°F.]. Third- and fourth-instar nymphs and adult apterae withstood heat better than first and second instars and alatae. When *M. persicae* was exposed to high temperatures for one hour, more Aphids died at 90 than at 60 per cent. relative humidity, and more at 60 than at 30 per cent. Aphids kept at 15 per cent. relative humidity for four hours before being exposed to the high temperature showed a higher mortality

than those kept at 95 per cent. *M. persicae* and *B. brassicae* on plants withstood temperatures higher than their thermal death-points off the plants. Presumably, Aphids can continue to cool themselves by evaporation while feeding ; also, lower temperatures on the surface of transpiring plant tissues will aid survival.

TAYLOR (L. R.). **An improved Suction Trap for Insects.**—*Ann. appl. Biol.* **38** no. 3 pp. 582–591, 1 pl., 2 figs., 3 refs. London, 1951.

The suction trap for small flying insects described by C. G. Johnson [*R.A.E.*, A **38** 296] gave excellent results during two seasons in the field, but was adversely affected by long exposure to bad weather and liable to damage from handling. Structural improvements chiefly designed to provide additional strength and to give protection from damp and dust were accordingly incorporated, and constructional details are given, together with suggested modifications for dealing with larger samples. The improved trap did not damage Aphids or other delicate insects.

BROADBENT (L.), TINSLEY (T. W.), BUDDIN (W.) & ROBERTS (E. T.). **The Spread of Lettuce Mosaic in the Field.**—*Ann. appl. Biol.* **38** no. 3 pp. 689–706, 4 figs., 11 refs. London, 1951.

The following is based on the authors' introduction and summary. Mosaic disease of lettuce causes losses not only in south-western England [*R.A.E.*, A **27** 671], but also in the Thames valley in Buckinghamshire, where spring and summer crops have suffered in recent years in addition to winter lettuce. The virus is transmitted through the seed and also by Aphids [*cf.* **27** 671 ; **35** 86 ; **37** 232–233]. The epidemiology of the disease was studied on two farms in Buckinghamshire during 1947–50. Two patterns of spread, one within a crop from sources initiated by seed-borne virus and one into a crop from neighbouring infected old plants, were obvious on one farm during 1947–48. The first type caused serious losses only when Aphids were unusually numerous and the incidence of seed-borne infection was high ; serious losses more often resulted from the second type. Winter crops usually suffered severely, and they initiated a cycle of infection in the spring, which continued from crop to crop throughout the year when Aphids were sufficiently numerous. Spread from crop to crop was much reduced during 1949–50 by planting or drilling lettuce in large blocks, well separated from each other, and by omitting a winter crop. Killing the infesting Aphids with an insecticide did not prevent the introduction of virus from neighbouring diseased crops. The insecticidal treatment of old, diseased and Aphid-infested crops, before the alates are produced, is recommended.

There were more diseased plants near hedges, woods, trees or buildings than in the open field, presumably because such barriers halted flying Aphids. Three species of Aphids were common on lettuce, *Myzus* (*Nasonovia*) *ribis-nigri* (Mosley) (*ribicola* (Kalt.)), which infests the heart-leaves, and *Macrosiphum solanifolii* (Ashm.) (*euphorbiae*, auct.) and *Myzus persicae* (Sulz.), which infest the outer leaves. *Macrosiphum solanifolii* and *Myzus persicae* are vectors of lettuce mosaic, but the former is less effective than *M. persicae*, which, although rarely as numerous as the other two species, is the most important vector [*cf.* **27** 671]. All three species overwintered on lettuce, and migrated from the winter crops during April–May. An obvious need in the control of lettuce mosaic is the production of virus-free seed. Without such seed, however, conditions can be made less favourable for the disease by planting or drilling lettuce crops in large blocks, well separated from each other, destroying diseased crops and crop-remains as soon as possible, treating winter crops with an insecticide in late November, and using insecticides to prevent the production of large Aphid populations, especially on old crops.

FULTON (R. A.), NELSON (R. H.) & YEOMANS (A. H.). **Evaluation of Liquefied-gas Aerosols.**—*Soap & sanit. Chem.* **27** no. 8 pp. 129, 131, 7 refs. New York, N.Y., 1951.

Liquefied-gas aerosols in the United States are covered by a patent issued to the Secretary of Agriculture. Non-exclusive licences to operate under it are granted and incorporate an agreement by the licensees to use toxicants and propellents acceptable to the Department of Agriculture in formulae in which the percentage of non-volatile ingredients is not more than 20. The aerosol must also produce a system of particles suspended in air of which 80 per cent. are less than 30 μ in diameter and none more than 50 μ. Formulations for household use must pass a test for knockdown and kill [*R.A.E.*, B **39** 6 ; **40** 15]. Those for use in greenhouses are approved on the basis of experimental results, and information is also required on plant tolerance [*cf.* A **38** 221–222].

Particle size can be determined from slides moved through the aerosol fog towards the nozzle by hand, but this method of collection has been modified by the use of an impactor consisting of a small variable-speed motor equipped with a counterbalanced slide holder. The slide revolves on a four-inch radius, and the motor unit is mounted in the centre of a 21-inch tube 36 ins. long, through which air containing the aerosol is drawn by means of a ventilating fan with a capacity of 2,400 cu. ft. per minute. The greatest speed at which the slide can be revolved to obtain a good sample is about 800 revolutions per minute, or 19 miles per hour, but a speed equivalent to 10 m.p.h. is recommended for all types of commercial aerosols. About 0·3 gm. of the aerosol solution should be released four feet from the impactor and drawn past it at approximately 12 m.p.h.

The proper design of nozzles and valves is important, since particle size can be changed by varying the size of the orifice and the structure of the valve. The most practical type of nozzle [*cf.* next abstract] is one that incorporates an expansion chamber between two orifices, the ratio of the inner to the outer being about 2 : 3, and the restricted inside orifice may be designed as a mitring rod, loose-fitting pin or any device that will give a satisfactory drop in pressure before the solution reaches the expansion chamber. Where a high discharge rate is necessary, a satisfactory aerosol can be produced by means of long capillary tubing ; the resistance to flow of a liquefied gas within such tubing is insignificant when compared with that of other liquids.

FULTON (R. [A.]), YEOMANS (A. [H.]) & ROGERS (E. [E.]). **Design of Nozzles for Low Pressure Aerosols.**—*Soap & sanit. Chem.* Sp. issue *Proc. 36th Mtg chem. Specialties Mfrs' Ass. 1950* pp. 51, 86–87, 1 fig., 1 ref. New York, N.Y., 1950.

FULTON (R. A.). **Insecticidal Aerosols.**—*Soap & sanit. Chem.* **27** no. 9 pp. 141, 143, 145, 4 figs., 5 refs. New York, N.Y., 1951.

In these two papers, somewhat similar accounts are given of investigations on the design of nozzles for producing particles of the requisite sizes in low-pressure liquefied-gas aerosols [*cf.* preceding abstract]. For applying high-pressure liquefied-gas aerosols in which dichlorodifluoromethane is the propellent, a nozzle constructed of 0·017-in. capillary tubing was found to give the most satisfactory particle size, and the length of the tubing could be varied considerably without changing the particle-size distribution. Capillary tubing can also be used for low-pressure aerosols, but a different length is required for each width of tubing to obtain a minimum particle size. The average median particle diameter of an aerosol released from a solution consisting of 2 per cent. each of DDT and pyrethrum extract (20 per cent. pyrethrins), 5 per cent. each of PD-544C (alkylated naphthalenes) and deodorised kerosene and

43 per cent. each of trichlorofluoromethane and dichlorodifluoromethane, which exerts a pressure of about 35 lb. per sq. in. at 70°F., varied between 16·3 and 50 μ when dispersed with 0·017-in. capillary tubes 0·02–6 ins. long. With capillary tubes 0·0135, 0·017, 0·024 and 0·029 in. in diameter, the most satisfactory lengths were 0·5–1, 0·75–1·5, 1–4 and 4–6 ins., respectively. The discharge rate is associated with the internal diameter and not with the length ; if high discharge rates are necessary, satisfactory aerosols can be produced with large capillary tubing in lengths of 4–6 ins.

As the pressure of an aerosol solution flowing through a capillary tube was found to drop considerably, nozzles comprising combinations of small orifices and expansion chambers were also tested. The most satisfactory had an expansion chamber of 0·008 cu. in. and orifices measuring 0·015 in. at the inlet and 0·021 in. at the outlet [*cf.* preceding abstract]. The delivery rate was about 1 gm. per second at 40 lb. per sq. in., and the difference in pressure between the expansion chamber and the aerosol container was about 5 lb. per sq. in. The spray was continuous, with no dripping at the outlet.

The first paper also contains notes on a method of testing the pressures in the aerosol container and expansion chamber, and the second descriptions and illustrations of various types of expansion-chamber nozzles.

DAHM (P. A.), FOUNTAINE (F. C.), PANKASKIE (J. E.), SMITH (R. C.) & ATKESON (F. W.). **The Effects of feeding Parathion to Dairy Cows.**—*J. Dairy Sci.* **33** no. 10 pp. 747–757, 3 figs., 18 refs. Baltimore, Md., 1950.

Cows that ingested 0·112 mg. parathion per kg. body weight daily for 81 days and two that were fed up to eight times as much at the end of the period showed no changes in health or reproductive ability, and no parathion was found in their milk. These amounts are much greater than those likely to be ingested with hay from lucerne sprayed in the field, which commonly bears residues of 1 part per million.

ROSEDALE (J. L.). **Nucleic Acid of Insects.**—*J. ent. Soc. sthn Afr.* **11** pp. 34–37, 9 refs. Pretoria, 1948.

The following is virtually the author's summary. The nucleotides of *Trinervitermes havilandi* Fuller and of the larvae of *Chrysomyia chloropyga* (Wied.) have been isolated and are found to be guanylic acid, adenylic acid, cytidylic acid and 5-methyl-cytidylic acid only. When the termites are killed with DDT, guanylic acid and cytidylic acid are still found to be present, but the 5-methyl-cytidylic acid has been changed to 5-methyl-cytidine-di-phosphoric-ester, and it was impossible to isolate any adenylic acid. The free base adenine has been recovered to the amount corresponding to that expected in termites that have not been treated with DDT and it appears that the phosphorus of the adenylic acid has been taken up quantitatively by the 5-methyl-cytidylic acid to form 5-methyl-cytidine-di-phosphoric-ester. Uracil and thymine could not be found in these insects and it is considered that methyl-cytosine is the parent substance of thymine.

STOFBERG (F. J.). **Larval Structure as a Basis for certain Identification of False Codling Moth** (*Argyroploce leucotreta*, **Meyr.**) **Larvae.**—*J. ent. Soc. sthn Afr.* **11** pp. 68–75, 4 figs., 3 refs. Pretoria, 1948.

In view of the difficulty often experienced in South Africa in recognising larvae of *Argyroploce leucotreta* Meyr., especially those on *Citrus* and certain subtropical and wild fruit, an attempt was made to find an outstanding

character by which they could be quickly identified by unaided sight. No such character could be found, and for certain identification the number and position of the setae must be determined by means of a binocular microscope. Detailed descriptions of the setae and their position on the head, thorax and abdomen are given, with a general description of the larva and the characters distinguishing it from that of *A. peltastica* Meyr., a pest of litchee in South Africa [*cf. R.A.E.*, A **39** 143].

Broekhuysen (G. J.) & Macnae (W.). **The 'Potato Grub' (*Agrotis* sp.). A serious Pest of Potatoes on the Island of Tristan da Cunha.**—*J. ent. Soc. sthn Afr.* **12** pp. 96–108, 3 figs., 2 refs. Pretoria, 1949.

Potatoes growing on Tristan da Cunha are severely damaged by the larvae of a moth that closely resembles *Agrotis* (*Euxoa*) *segetum* (Schiff.). It has been diversely identified in the literature and is referred to in this paper as *Agrotis* sp. It was not of importance prior to the substitution of sheep manure for kelp as a fertiliser. Infestation begins in late December or early January, when the plants are well developed ; prior to the establishment of the Naval Station on the island, it began in early November, but the moths are now attracted to the lights of the Station and do not reach the main area of cultivation until later. The larvae remain in the soil near the plants during the day and feed at night on the leaves, which they ultimately destroy ; on wet, chilly days, they remain on the plants. They occur on all the low parts of the island, attack many plants besides potatoes, including many vegetables, and were observed feeding on mushrooms and grasses.

The only control measure practised is the collection and destruction of the larvae on days when they are on the plants, but this is ineffective. In laboratory experiments, leaves treated with a suspension of 1 oz. lead arsenate in 1 gal. water did not prove very effective, but a wettable powder containing 50 per cent. DDT applied to the leaves at the same concentration and a moistened bait of sodium fluosilicate bran (1 : 12 by weight) both gave averages of about 90 per cent. mortality in 24–60 hours ; there was some reduction in mortality when bait that had been prepared four days earlier was used. In the field, the DDT spray and the bait gave 100 and 62·7–85·5 per cent. reduction in population, respectively, after two days, and 97·4 and 66·5 per cent. when applied at half strength. The effectiveness of the spray was not reduced by rain falling one hour after treatment. Applications should be begun when infestation first becomes apparent and be repeated when the plants become reinfested. The effectiveness of the bait might be increased by the addition of sugar.

Bradford (B.), Whitehead (G. B.) & Altona (R. E.). **A Coccid Pest of Turf.**—*J. ent. Soc. sthn Afr.* **12** pp. 134–136, 3 figs. Pretoria, 1949.

Antonina indica Green has of late become injurious on golf courses along a narrow strip of the coast in Natal, where this Coccid has either been newly introduced or only recently become a pest of turf. The crawlers are numerous on the greens in hot, sunny weather, especially during December–March, when the damage is most severe. The grass may later recover temporarily. They attach themselves to the stolons in the leaf axils at the surface of the ground, and, as a result of their feeding, the grass turns brown. Fine grasses are more readily attacked than coarse ones. The honeydew produced by the Coccids is attractive to *Myrmicaria natalensis* (F. Sm.) and *Camponotus rufoglaucus* (Jerd.), and these ants were numerous on infested greens at one golf course. Females of *A. indica* are viviparous, and produce crawlers over a period that probably lasts several weeks. No males were observed.

SNYMAN (A.). **The Influence of Population Densities on the Development and Oviposition of** *Plodia interpunctella* **Hübn. (Lepidoptera).**—*J. ent. Soc. sthn Afr.* **12** pp. 137–171, 5 graphs, 19 refs. Pretoria, 1949.

In the investigations described, larvae of *Plodia interpunctella* (Hb.), which has been used as a host for rearing laboratory stocks of parasites [*R.A.E.*, A **22** 81], were reared in quart jars with organdie covers. A mixture of equal weights of maize-germ meal and coarse maize bran proved more satisfactory as a rearing medium than maize meal alone or mixed with four times its weight of ground groundnuts or than crushed maize. A 2 : 1 mixture of germ meal and bran was subsequently used. Corrugated strips were provided for pupation. For oviposition, moths were confined in cylindrical tins, 1½ ins. high and with a basal area of 1·54 sq. ins., of which the bottom was composed of 24-mesh wire gauze ; these were placed over an oviposition medium of finely sifted flour and french chalk, from which the eggs were subsequently recovered by sifting. Considerable mortality was at first caused among the larvae by a protozoon identified as *Mattesia dispora* [**26** 598], but no trouble was experienced after a healthy stock had been reared from an uninfected source.

It was found that as larval density increased, mortality increased and the size of the moths that developed was reduced. The optimum density for egg-production was found to be 0·4 gm. food mixture per larva. The highest number of eggs per female over a period of 48 hours was obtained at a density of two pairs per tin, and a significantly higher average number of eggs was obtained from females collected while mating than from others that were not seen pairing.

MYBURGH (A. C.). **Experiments with "Gammexane" for Ant Control and Eradication in Citrus Orchards.**—*J. ent. Soc. sthn Afr.* **12** pp. 172–173. Pretoria, 1949.

In experiments on the control of *Anoplolepis custodiens* (F. Sm.) in *Citrus* orchards in the Sundays River Valley, Cape Province, where this ant is associated with *Coccus hesperidum* L., Gammexane [γ benzene hexachloride] applied to the trunks of the trees or to the ground in dusts or sprays or on bands placed round the trunks gave control for at least 3–4 weeks in April or May, when the average maximum temperatures were 80 and 77°F., respectively, but for no more than one week in summer, when the average maximum was 85°F. In similar experiments, DDT appeared to be less toxic and not persistent enough to give prolonged control. The eradication of the ant from the orchards offers more promise of success than control by means of a volatile insecticide, but is difficult because infestation is most severe round the edges and may be renewed by infiltration from outside.

OMER-COOPER (J.) & MILES (P.). **On** *Lema trilineata* **—a Beetle closely resembling the Tobacco Slug, attacking the Cape Gooseberry.**—*S. Afr. J. Sci.* **47** no. 12 pp. 330–333, 4 figs. Johannesburg, 1951.

In February 1950, cape gooseberry (*Physalis peruviana*) was attacked throughout the Albany and Bathurst districts of South Africa by the larvae and adults of a beetle distinct from *Lema bilineata* (Germ.) and identified as *L. trilineata* (Ol.). As a result of feeding, the plants were completely defoliated, but in some areas, damage was prevented by early spraying with lead arsenate. *L. trilineata* does not occur in South America, and cape gooseberry is therefore not a natural food-plant. It was only occasionally observed on this crop prior to 1950, but had been noted feeding on *Datura stramonium*, and during the outbreak this weed was completely cleared from maize fields by the larvae. The outbreak may have been due to the long period of drought that culminated

in the summer of 1949–50, or, more probably, to the development of a physiological race adapted to a food-plant hitherto unsuited to the species. The abundance of *L. trilineata* may also have been due to the adverse effect of the drought on other insects. No predators were observed, possibly because the larvae are protected from them by the mass of excrement on their backs. A Tachinid parasite that attacks larvae that have passed the first instar and pupates in the cocoon of the host caused at least 75 per cent. mortality ; adults of this parasite were numerous in April. Adults of *L. trilineata* are thought to appear in November and are active for about seven months ; the females oviposit soon after emergence, and there are five or six generations a year. The eggs are deposited in masses, usually of 15–30, on shaded parts of the leaf. The larvae feed, at first gregariously, on the leaves, and when fully fed, burrow into the soil to a depth of about 1 in., where they pupate in earthen cells. The egg, larval, prepupal and pupal stages last 6, 9–11, 3–4 and 6–10 days, respectively ; the adults remain in the cells for up to eight days before appearing. Many adults overwinter in dark, sheltered places, often in the empty sheaths that surround the fruits ; they become active if exposed to light and heat, but the females have not been observed to oviposit during winter. Adults of both sexes fly strongly in warm weather.

BERAN (F.). **Weitere Untersuchungen über die "Frostspritzung" von Obstbäumen.** [Further Investigations on Fruit-tree Spraying during Frost.] —*Pflanzenschutzberichte* **3** pt. 11–12 pp. 161–176, 13 figs., 1 ref. Vienna, 1949. (With a Summary in English.)

In further tests in Austria in the winter of 1948–49 on the increased effectiveness of dormant sprays applied to fruit trees in frosty weather [*cf. R.A.E.*, A **39** 363], apple and pear trees infested by *Quadraspidiotus perniciosus* (Comst.) were sprayed with 4 per cent. of a heavy-oil fruit-tree carbolineum containing 87·2 per cent. tar distillate or 2·5 per cent. of a mineral-oil emulsion containing 79·1 per cent. oil. The carbolineum gave 99·84–100 and 81·6 per cent. control as compared with no treatment when applied at temperatures below and above freezing point, respectively, and the mineral oil 99·56–99·88 and 46·55 per cent. When the carbolineum was applied to peach at 2·5–4 per cent. at −4°C. [24·8°F.], it gave complete mortality at all concentrations.

In tests on ovicidal effect, the sprays were applied to eggs of *Aphis* (*Doralis*) *pomi* Deg., *Operophtera* (*Cheimatobia*) *brumata* (L.) and *Paratetranychus* (*Tetranychus*) *pilosus* (C. & F.). The control percentages at −4 and (in brackets) 20°C. [68°F.] for carbolineum at 4, 5 and 8 per cent. were 84·8 (41·35), 100 (55·7) and 100 (100), respectively, against *A. pomi*, 94·1 (42·05), 99·65 (55·5) and 100 (99·65) against *Operophtera* and 80·7 (48·05), 90·95 (73·45) and 99·75 (98·8) against *Paratetranychus*. The corresponding figures for the mineral-oil emulsion at 2, 3 and 5 per cent. were 48·4 (14·7), 89·45 (40·2) and 97·95 (61·1) against *A. pomi*, 51·45 (3·4), 91·6 (41·3) and 95·7 (73·4) against *Operophtera*, and 88·45 (43·2), 98·8 (51·6) and 100 (63·8) against *Paratetranychus*.

No damage was caused to the buds of apple, pear, apricot, peach, plum or cherry by spraying during frost, and the procedure is now recommended for general use.

BÖHM (H.). **Untersuchungen über die Lebensweise und Bekämpfung der Kirschfliege** (*Rhagoletis cerasi* **L.**). [Investigations on the Bionomics and Control of *R. cerasi*.]—*Pflanzenschutzberichte* **3** pt. 11–12 pp. 177–185, 7 refs. Vienna, 1949.

In view of increased infestation of medium-late and late varieties of cherry by *Rhagoletis cerasi* (L.) in many parts of Austria, investigations on its

bionomics and control were carried out in 1947 and 1948 near Vienna, where up to nearly 170 puparia per sq. yard were found in the soil beneath the trees. Observations of collected puparia and catches in glass jars baited with 10 per cent. sugar solution and 1 per cent. ammonium fluoride [*cf. R.A.E.*, A **35** 143, etc.] hung in the trees showed that most of the adults emerged during the third week of May in 1947 and during the fourth week in 1948. The flight period in both years lasted for 50–60 days. The females oviposited 8–10 days after emerging, laying 40–50 eggs each in 14–16 days. Oviposition ceased at temperatures below 16°C. [60·8°F.].

In experiments on control, Gesarol 10 (10 per cent. DDT), Gesarol 50 (50 per cent. DDT) and E 605 f, which is defined as thiophosphoric acid esters*, were used in water at 1, 0·2 and 0·05 per cent., respectively. Filter papers treated with these materials and allowed to dry caused knockdown of adults in 5, 4 and 2 hours and complete mortality in 14, 12 and 7 hours, respectively. In field experiments in 1948, the same materials were applied in sprays to the trees ten days after the beginning of adult emergence. Second and in some cases third applications were made at intervals of eight days, and a wetter was added to the two DDT sprays. The average percentages of fruits infested after two and (in brackets) three applications of the three sprays were 11 (8·5), 10 (6) and 9(7·5), respectively, on medium-late varieties, and 28 (6·5), 27 (4) and 30 (8·5) on late varieties, as compared with 85 and 88 for no treatment. DDT is recommended for practical use as it is less toxic than E 605 f to man. Two applications should be made on medium-late varieties and three on late ones.

BÖHM (H.). **Beitrag zur Bekämpfung des Mauszahnrüsslers** (*Baris chlorizans* **Germ. und** *Baris laticollis* **Mrsh.**). [A Contribution to the Control of *B. chlorizans* and *B. laticollis*.]—*Pflanzenschutzberichte* **4** pt. 7–8 pp. 99–105, 1 fig., 5 refs. Vienna, 1950. (With a Summary in English.)

Severe injury to cabbage by *Baris chlorizans* (Germ.) and *B. laticollis* (Marsh.) was reported in 1948 from a district in Lower Austria that is largely given over to the cultivation of that crop. The little that is known of the bionomics of these weevils is summarised from the literature [*cf. R.A.E.*, A **11** 114]. In the winter of 1948–49, adults and pupae were found overwintering in crop remains but not in the soil. In experiments in 1949 on the use of insecticides to control the ovipositing adults, dusts of 5 per cent. DDT and 8 per cent. BHC (benzene hexachloride) and E 605* dust (1·5 per cent. thiophosphoric acid esters) at 90, 90 and 45 lb. per acre, respectively, and a spray of 0·05 per cent. E 605 forte (46 per cent. thiophosphoric acid esters) were compared. They were tested against each species separately in the laboratory by caging adults with treated plants. DDT proved ineffective, though somewhat repellent, BHC gave complete mortality of each species in three days and the E 605 dust in two, and the E 605 spray gave complete mortality of *B. chlorizans* in one day and of *B. laticollis* in two. Treatments were applied in the field as soon as the first adults were seen, and repeated once or twice at intervals of 14 days. The percentages of infested plants in the controls ranged from 58 to 70 per cent. DDT again proved rather ineffective ; two applications of the other materials gave fair results, and three applications reduced the infestation percentages to 8–10 for BHC and to 0–3 and 2–5 for the E 605 dust

* E 605 was originally used in Germany as a designation for parathion (O, O-diethyl O-p-nitrophenyl thiophosphate), E 605 f being an emulsion concentrate containing about 70 per cent. of it. More recently, however, E 605 has also been used for mixtures containing parathion and its methyl homologue, and E 605 forte for an emulsion concentrate containing about 50 per cent. active esters.—*Ed.*

and spray, respectively. A seed crop was completely protected by four applications of the BHC or E 605 dust at intervals of eight days.

WATZL (O.). **Zur Lebensweise und Bekämpfung des Rübenerdflohs** (*Chaetocnema tibialis* **Illig.**). [On the Bionomics and Control of *C. tibialis*.]—*Pflanzenschutzberichte* **4** pt. 9–10 pp. 129–149, 3 figs., 18 refs. Vienna, 1950. (With a Summary in English.)

Damage to sugar-beet by adults of *Chaetocnema tibialis* (Ill.) was unusually heavy in eastern Austria in the spring of 1948. Young shoots still below soil level and later the leaves of the growing plants were attacked, and though the older plants usually survived, seedlings were mostly killed. *Phyllotreta atra* (F.), which feeds chiefly on weeds [*cf. R.A.E.*, A **23** 703], was also common in the fields, and as it has been reported to attack sugar-beet, feeding tests were carried out. Adults caged for 12 days with young beet plants did not feed on them even when no alternative food was available.

Characters by which *C. tibialis* can be recognised in the field with a hand lens are described, and its distribution, food-plants and bionomics are reviewed from the literature [*cf.* **20** 7 ; **21** 267]. In Austria, most of the overwintered adults appeared at the end of April ; pairing was observed in May, and adults of the new generation were observed in the field until autumn, when they sought hibernation sites. Overwintering adults were found in the upper layers of the soil and beneath litter in woodland near beet fields.

In experiments on chemical control in 1949, Gesarol dusts containing 5 or 10 per cent. DDT applied to the plants in May at about 27 lb. per acre were superior to a DDT spray or a dust containing E 605 (thiophosphoric acid esters [*cf.* **40** 45]) and gave very good control, whereas sprays of E 605, tobacco extract with soft soap, or calcium arsenate were unsatisfactory. Control was evaluated by counting the numbers of feeding holes on young leaves that opened after the plants had been treated. Supplementary control methods recommended are early sowing of beet and catching the flea-beetle adults by means of mobile traps having boards covered with an adhesive [*cf.* **20** 7 ; **31** 283, etc.]. These should be used repeatedly in spring.

PRIMOST (E.). **Weitere Untersuchungen über den Einfluss von DDT auf Wurzelentwicklung, Keimfähigkeit und Triebkraft einiger Kulturpflanzen.** [Further Experiments on the Influence of DDT on Root Development, Germination and Vigour of some cultivated Plants.]—*Pflanzenschutzberichte* **4** pt. 9–10 pp. 150–164, 1 fig., 9 refs. Vienna, 1950. (With a Summary in English.)

In further investigations in Austria on the effect of DDT on plant growth [*cf. R.A.E.*, A **39** 424], rape and kohl-rabi seedlings developed normally when transferred to pots containing soil mixed with 0·02 and 0·05 per cent. DDT. The germination of rape seed was unaffected but that of tomato was retarded in water containing 0·05 per cent. DDT. When barley, rye, wheat and oat seed was dusted with 0·1 and 0·2 per cent. Gesarol containing 10 per cent. DDT and planted in sand ten days later, germination was not affected by the lower rate, which is that used for treating stored grain [*cf.* **36** 38], but the percentage of viable seed was slightly reduced, the time required for germination increased, and subsequent root development inhibited by the higher one, although only rye produced shorter straw. In the case of barley, the adverse effects were negligible. Since these tests were carried out in pots, the results may not apply in the field.

KRAEMER (G. D.). **Der grosse Tannenborkenkäfer, unter Berücksichtigung seiner beiden Verwandten und der Brutbaumdisposition** *Pityokteines curvidens* **Germ.,** *vorontzowi* **Jakobs. und** *spinidens* **Reitt.** [*Ips curvidens*, with Consideration of the two allied Species *I. vorontzowi* and *I. spinidens* and the Condition of the Trees in which they breed.]—*Z. angew. Ent.* **31** pt. 3 pp. 349–430, 31 figs., 45 refs. Berlin, 1950.

Following outbreaks of *Ips* (*Pityokteines*) *curvidens* (Germ.) on silver fir (*Abies alba*) and other conifers in forests in southern Germany in the late summer of 1947, the author undertook investigations on the bionomics and control of this Scolytid and of *I.* (*P.*) *vorontzowi* Jakobs. and *I.* (*P.*) *spinidens* Rttr., which accompanied it [*cf. R.A.E.*, A **30** 246]. The geographical distribution of these bark-beetles is discussed, the trees attacked by them are reviewed, and keys to the adults of both sexes are given.

The duration of the life-cycle of *I. curvidens* varied with temperature and was estimated from observations in one area to last 52–165 days. There were two generations a year and sometimes a partial third. The females entered the bark in spring and laid an average of 130–140 eggs each, spaced regularly along the galleries at about 35 per inch. The larvae tunnelled vertically up or downward in the bark and in most cases entered the wood to pupate, the adults emerging from the end of June. The females oviposited, and some of them subsequently deposited a few eggs of a second brood in other galleries. Most of the second-generation larvae had pupated by autumn. Some of the resulting females overwintered without leaving the trees in which they had developed, while others left the trees and oviposited, subsequently overwintering beneath bark scales or other shelter. Larvae also overwintered, feeding when temperature permitted and becoming full-fed by spring. There was thus considerable overlap between generations. The trees were usually attacked in the trunks and took on a reddish colour resembling that caused by drought. The possibility of its being due to poisoning by excreta or to chemical reaction is discussed.

Four types of feeding by the adult females are recognised and are described. These are maturation feeding, which is carried out beneath the bark of the trees in which the beetles have developed, the feeding that occurs during the construction of the maternal galleries, regeneration feeding (during which eggs of the second brood are laid), and feeding before overwintering, which takes place in healthy trees and provokes considerable flow of resin.

The effect of temperature on the adults was tested in glass beakers lined with wire gauze and bark. The beakers were cooled overnight to 3°C. [37·4°F.] and then warmed to 19°C. [66·2°F.] in three hours. The adults became active at 4–5°C. [39·2–41°F.], and their activity increased with the temperature until most were on the wing at 18°C. [64·4°F.] and all at 19°C. In a test on the effect of solar radiation, some individuals were kept from early morning in constant sunlight and others in the shade. Those in sunlight were on the wing at 14°C. [57·2°F.], and those in the shade at 18°C. The conclusion that sunlight favoured flight was confirmed in field observations. Specially insulated thermometers were used to measure the temperature of the bark of forest trees in direct sunlight. All adults left bark having a temperature of 44°C. [111·2°F.], and laboratory tests indicated that the upper limit for survival lay just below 60°C. [140°F.]. The effect of low humidity was not known ; larvae survived in samples of wood and bark containing 17·8 and 18·8 per cent. moisture, respectively, but not in those containing 16·2 and 16·5 per cent.

The bionomics of *I. vorontzowi* and *I. spinidens* were similar to those of *I. curvidens*, but their attacks were confined to the twigs and branches. Differences in the feeding patterns are discussed. No regeneration feeding was observed in *I. vorontzowi*. The pupal chambers of *I. spinidens* were rarely formed in the wood and were normally only depressions in the feeding galleries.

Lists are given of the predators, parasites and other insects found in association with the three species. The predators were largely Staphylinids and other Coleoptera, and the parasites, notes on which by H. Sachtleben are included, comprised *Pachyceras* (*Roptrocerus*) *xylophagorum* Ratz., from larvae of all three, and *Pteromalus capitatus* Först. and *Ecphylus hylesini* (Ratz.), from *I. spinidens*.

In investigations on the factors permitting the establishment of infestation, adults of the three species from freshly-attacked bark were placed in batches of 20 under wire-gauze covers on selected trees. All individuals entered the bark of some trees, and none that of others. It was considered that the production of resin in firs is not sufficient to be a decisive factor in preventing attack, and a correlation with the osmotic pressure of the sap was sought. This was measured by a technique that is described, and the results are given in tables. The osmotic pressure in healthy firs varied from about 10 atmospheres in the living bark at the base to about 28 atm. in the needles in sunlight at the crown. In drought, the normal physiological reaction was a reduction in osmotic pressure. When it fell to 7–8 atm. or below, *I. curvidens* was able to breed in the tree. The upper limit for *I. vorontzowi* and *I. spinidens* was about 10 atm., although adults of *I. spinidens* that had begun to oviposit continued to do so whatever the osmotic pressure. Since uninfested firs do not die until the osmotic pressure in the bark falls to 4 atm., trees selected for attack are not necessarily moribund.

From a detailed study of the potential rates of increase of *I. curvidens*, it is concluded that infestation spreads as quickly as trees with a sufficiently low osmotic pressure become available, so that outbreaks may be expected to occur suddenly. The osmotic pressure falls not only as a result of drought, but also following attack by other pests and feeding before overwintering by adults of *I. curvidens*. The direct financial loss due to infestation by *I. curvidens* was not great, but two cases are cited in which infestation resulted in the entire loss of mixed stands, since the felling of infested firs caused a reduction of the soil water-supply, drought through increased sunlight, and increased wind damage.

Control of *I. curvidens* has proved difficult on account of the habit of the larvae of pupating in the wood. In tests with insecticides, sprays of DDT, benzene hexachloride or E 605 f [*cf.* **40** 45, note] were applied to infested logs from which the bark had been removed. The most effective was E 605 f, which gave 95 per cent. mortality of the larvae in 5–28 days, depending on temperature. In the spring of 1948, tar distillates (undiluted carbolineum and fruit-tree carbolineums emulsified in water) were tested. The undiluted material gave 100 per cent. mortality within a few days, but the emulsions failed to penetrate the frass blocking the larval galleries. The use of trap logs against the beetles is discussed. Trunks should be felled progressively throughout the season against *I. curvidens* and exposed in groups at irregular intervals in shaded parts of the stand. If they become infested the bark should be removed, and if larvae have entered the wood, this should be treated with tar distillate. Branches should be similarly used to trap *I. vorontzowi* and *I. spinidens* and should be burnt when infested.

RIEMSCHNEIDER (R.). **Über die Steigerung der Initialtoxizität und Dauerwirkung des β, β, β-Trichlor-α,α-bis-(4-chlor-phenyl)-äthans (p,p′-DDT-Wirkstoff).** [Increasing the initial Toxicity and Duration of Effectiveness of p,p′DDT.] —*Z. angew. Ent.* **31** pt. 3 pp. 431–440, 1 fig., 16 refs. Berlin, 1950.

In laboratory experiments in Germany in which dusts containing 5 per cent. active ingredient in talc were tested against *Melophagus ovinus* (L.) for immediate effect, the numbers of minutes required for 50 and (in brackets) 80 per cent. knockdown were 35 (52) for p,p′DDT, 33 (50) for technical DDT,

less than 15 (less than 15) for fluoro-DDT (α,α-bis(4-fluorophenyl)-β,β,β-trichloroethane), 95 (134) for ethyl-DDT (α,α-bis(4-ethylphenyl)-β,β,β-trichloroethane), 58 (103) for α,α-bis(3,4-fluoromethylphenyl)-β,β,β-trichloroethane, 500 (over 730) for α,α-bis(2,4-dimethylphenyl)-β,γ,γ-trichloro-β-propylene and 38 (54) for chlordan (M 410). When the dusts contained 5 per cent. of fused mixtures of p,p′DDT with other halogenated hydrocarbons, the numbers of minutes were 19 (36) for a mixture of DDT, fluoro-DDT and ethyl-DDT, 18 (41) for one of DDT, the fluoromethyl analogue and technical M 414 (octachloroendomethylene-trimethyl-cyclohexane), 36 (54) for DDT with the propylene compound, 23 (40) for DDT, ethyl-DDT and technical M 414, and 29 (48) for DDT, the fluoromethyl analogue and chlordan. In tests for prolonged effect, *Drosophila melanogaster* Mg. was exposed to deposits of dusts containing 3 per cent. active ingredients (p,p′DDT or fused mixtures) 0–35 weeks after application. The numbers of minutes required for 80 per cent. knockdown immediately and (in brackets) after 35 weeks were 35 (53) for DDT, 27 (44) for DDT with ethyl-DDT, 25 (39) for DDT with the fluoromethyl analogue, and 27 (40) for DDT with technical chlordan and technical M 414.

As regards initial toxicity, fluoro-DDT is known to be more effective against many insects than DDT [*cf. R.A.E.*, A **40** 9], but the main reason for the superiority of mixtures with less effective materials is held to be the reduction or elimination of the tendency of DDT to crystallise, so that finer particles and consequently more intimate contact are obtained. This may also be the reason for the superiority sometimes observed of technical DDT over p,p′DDT. Some authors attribute its superiority to the greater effectiveness of some of the impurities in it, but the most active of these (m,p′DDT and α-chloro-α-(4-chlorophenyl)-β,β,β-trichloroethane) are present in extremely small quantities, and in an experiment, the addition of 0·5 per cent. of either of them to p,p′DDT did not increase the effectiveness of dusts containing 5 per cent. toxicant. The effect of the physical form and degree of dispersion of DDT is illustrated by its varying effect on bed-bugs (*Cimex lectularius* L.), which are killed by a 10–15 per cent. dust but are not affected by contact for five days with pure crystalline p,p′DDT.

The increased duration of effectiveness of the mixtures is held to be due to inhibition of the dehydrohalogenation of DDT. It is known that p,p′DDT is easily dehydrohalogenated in the presence of small amounts of certain metallic compounds, whereas the technical product, which usually contains metallic chlorides in small quantities, is less easily decomposed, owing to the inhibiting action of other by-products [*cf.* **35** 413].

The crystalline form and hence the effectiveness of DDT deposits from solutions is also affected by the solvent used, and this is illustrated by further tests with *D. melanogaster*, in which deposits from acetone solutions were more rapid in action than those from ethyl alcohol, ethyl ether or light benzene [*cf.* B **38** 204]. In tests on increasing the effectiveness of deposits of DDT and chlordan from acetone solutions, knockdown of *Calandra granaria* (L.) was increased by about 10–15 per cent. when halogenated phenols (chlorocresols and fluoroxylenes) were added to the dishes in small amounts sufficient to stimulate but not harm the weevils. This increase is not considered sufficient for practical use. The deposits appeared to be less effective in the dark than in normal light.

GÄBLER (H.). **Vorteile der Frühbestäubung bei der Nonne unter besonderer Berücksichtigung der Tachinenvermehrung.** [The Advantages of early Dusting against the Nun Moth with particular Reference to the Increase of Tachinids.]—*Z. angew. Ent.* **31** pt. 3 pp. 441–454, 16 refs. Berlin, 1950.

Wellenstein recommended that dusts for the control of the nun moth [*Lymantria monacha* (L.)] should be applied in spring, as soon as 90 per cent.

of the larvae have reached the crowns of the trees [*cf. R.A.E.*, A **35** 240]. The author agrees with this, except for the later years of an outbreak, when the larvae hatch over a long period and it is not necessary to wait for those whose development is retarded, since they suffer high mortality [*cf.* **35** 234], and illustrates the advantages of early treatment from experience gained in western Thuringia in 1944, when dusts containing dinitro-o-cresol were applied to large areas of spruce forest from aircraft. The main advantages are economy in labour, materials and flying time, reduced risks of scorching either the trees or crops growing at the edge of the treated area, greater susceptibility of the larvae [*cf.* **35** 239] and less injury to the important Tachinid parasite, *Phorocera silvestris* (R.-D.) (*Parasetigena segregata*, auct.), the adults of which do not emerge until later.

Blaszyk (P.) & Madel (W.). **Beitrag zur Überwinterung und Fortpflanzungsbiologie von *Blitophaga opaca* L. (Coleopt.).** [Contribution to the Hibernation and Reproductive Biology of *Silpha opaca*.]—*Z. angew. Ent.* **31** pt. 3 pp. 455–472, 6 refs. Berlin, 1950.

The investigations described were begun in eastern Germany in 1944 in order to facilitate the rearing of large numbers of *Silpha* (*Blitophaga*) *opaca* L. for laboratory studies at any time of the year. Overwintering adults were sought in the vicinity of a sugar-beet field in the autumn. They were found mainly beneath thick clumps of long grass between trees bordering a road and in an adjacent orchard, and were not numerous at the edge of a wood [*cf. R.A.E.*, A **15** 123; **18** 459]. Dry soil, rich in humus or sandy, but not dusty, was preferred, and the presence of thickly matted grass was favourable. The adults were successfully kept at low temperatures in boxes containing turves on a layer of earth, and they were reared at high humidity in trays of earth in which beet, rye or wheat was sown in a greenhouse or in special rearing cages by techniques that are described. Adults taken from the field to the unheated greenhouse in September entered the soil at the end of that month. Heating was begun two weeks later, and after a further week, the beetles reappeared and reproduced without having been subjected to low temperatures. Overwintering adults taken at intervals in November, December and January became active when kept at 17°C. [62·6°F.] or above. After one or two days' feeding at 18–20°C. [64·4–68°F.] they paired, the females oviposited and larvae were obtained 14 days after the beginning of feeding. Provided that the soil was kept moist, the larvae were reared with insignificant mortality at first on beet and spinach shoots and later on beet leaves. Optimum temperatures were 14·5°C. [58·1°F.] for the young larvae and 17°C. for older ones. They pupated and gave rise to adults only in soil with a temperature above 15·2°C. [59·36°F.]. It was found advantageous to separate the various stages and instars, as they had different food and temperature preferences.

Fiedler (H. G.). **Studien zur Biologie und Bekämpfung der Kaffeewanzen (*Antestia lineaticollis* Stål und *A. faceta* Germ.) in Ostafrika.** [Studies on the Biology and Control of *A. lineaticollis* and *A. faceta* on Coffee in East Africa.]—*Z. angew. Ent.* **31** pt. 3 pp. 473–499, 3 figs., 11 refs. Berlin, 1950.

Coffee in the Kilimanjaro and Meru areas of Tanganyika is attacked by two species of *Antestia*, *A. lineaticollis* (Stål), which is by far the more numerous, and *A. faceta* (Germ.), which is of subordinate importance. In view of discrepancies in the literature on their bionomics in East Africa [*R.A.E.*, A **26** 178, etc.], much of which is reviewed, field and laboratory observations were

carried out in which special attention was given to the effects of temperature. The processes of hatching and pairing are described, and the dimensions of the adults are shown in a table.

The eggs of *A. lineaticollis* hatched in 5–8 days in the hot dry season (December–March), and most hatched in 6 days at monthly averages of 22–33·4°C. [71·6–92·1°F.]. In the cool rainy season (March–June), when the temperature fell to 18°C. [64·4°F.], the egg stage lasted up to 12 days. That of *A. faceta* lasted 5–6 days in the hot season.

The nymphs and adults sucked the juices from the flower buds and from all but the youngest of the berries, older nymphs and adults piercing the endocarp in unripe berries and infecting them with *Nematospora*. The nymphs took no food for 3–4 days after hatching, but died unless food was provided within 6–7 days. The nymphal stage of *A. lineaticollis* lasted 48–61 days in the dry season and 55–80 days in the rainy season at average temperatures of 23·9 and about 21·6°C. [75 and 70·9°F.], respectively, and that of *A. faceta* 43–46 and 42–50 days. The adults of both species were most active on warm, dry days, but did not fly readily if undisturbed. Caged males and females of *A. lineaticollis* lived for averages of 82 and 85 days in the hot season and 99 and 113 days in the cool season, respectively. When kept without food, they died in 2–5 and 4–6 days at 21·1°C. [about 70°F.] and over 60 per cent. relative humidity. The females oviposited 9–14 days after emergence and 4–7 days after first pairing, and paired repeatedly although this was not necessary to maintain the fertility of the eggs. The eggs were laid on the undersides of the leaves or sometimes on the berries in batches mostly of 11–12. On the average, a female laid 144 eggs in 12·5 batches in 40 days. It is calculated that an average of four generations per year is normally produced. Both species were present in the plantations throughout the year, but their numbers reached a peak in January–February and fell to a minimum during the rainy season. The distribution of the bugs was not uniform, since they sought the sun at high altitudes and the shade at low ones. It is considered that the nymphs and adults derive proteins from the unripe berries and carbohydrates from the flower buds and ripe fruits, and that neither alone is sufficient for normal development and oviposition [*cf.* **26** 178]. Examples that had been fed for some time on unripe berries alone eagerly attacked ripe berries and buds as soon as they were provided. A probable alternative source of carbohydrates was nectar from the shade tree, *Grevillea robusta*, which flowers after the coffee harvest at low altitudes.

The only parasite of economic importance was the Stylopid, *Corioxenos antestiae* Blair [*cf.* **26** 179], which kept the *Antestia* population at a low level during May–October, but was unable of itself to prevent annual outbreaks. Bait-sprays of sodium arsenite and sugar, which are commonly used against *Antestia*, do not harm the parasite [*cf.* **26** 179]. They should be applied twice, when neither ripe berries nor flower buds are present [*cf.* **23** 70], at an interval of 14 days.

KLIEWE (H.). **Leitfaden der Entseuchung und Entwesung.** [Guide to Disinfection and Disinfestation.]—3rd revd. edn., viii+126 pp., 62 figs. Stuttgart, F. Enke Verlag, 1951. Price unbound *DM.* 5; bound *DM.* 6.60.

In the first part of this handbook, the author deals with hygienic precautions and disinfection with reference to infectious diseases, and in the second, with animal pests, almost all of them insects, that are of hygienic importance or are household pests, particularly in Germany. The latter include species that are injurious to various stored products, fabrics, structural timbers or wooden furniture or are otherwise harmful or a nuisance in houses. The information on them comprises notes on their bionomics, importance and control. A section on control by fumigation is appended.

THIEM (H.). **Die San José-Schildlausgefahr und ihre Überwindung.** [The Danger of the San José Scale and its Control.]—*Agrarwiss. u. Agrarpolitik* **15,** 88 pp., 32 figs., 15 refs. Cologne, Westdtsch. Verlag, 1951.

In view of the outbreak of the San José scale [*Quadraspidiotus perniciosus* (Comst.)] on fruit trees and bushes in south-western Germany [*cf. R.A.E.*, A **38** 224], this booklet has been compiled to give growers information on its control. Measures applicable at various times of the year and the insecticides that are effective against it are reviewed, a programme of sprays is outlined, and a list is given of its food-plants, with indications of their importance.

STARÝ (B.). *Hyphantria cunea*, **nový škůdce v Československu.** [*H. cunea*, a new Pest in Czechoslovakia.]—*Ochr. Rost.* **21** pt. 5–6 pp. 38–43, 2 figs. Prague, 1948. (With a Summary in Russian.)

Since 1947, *Hyphantria cunea* (Dru.) has entered southern Slovakia in considerable numbers from Hungary [*cf. R.A.E.*, A **38** 162], several districts being heavily infested. All stages are briefly described. Its bionomics, as observed in Slovakia, are similar to those in Hungary [*loc. cit.*]. There are two generations a year, adults being present in June and again in August-September, and the second is the more numerous and harmful. Several variations in the coloration of the adults and in the number and distribution of the spots on the wings have been observed. The females lay up to 500 eggs each. The larvae feed chiefly on *Acer negundo* and mulberry, which they defoliate, and also attack various other fruit and shade trees. At least one third of the pupae collected were parasitised by Tachinids and Ichneumonids. Spread is chiefly effected by transport, and the author observed larvae in a greengrocer's cart in a market in an uninfested locality, and also on the clothes of travellers. The importance of organised control is emphasised. The measures recommended [*cf. loc. cit.*] include dusting or spraying with DDT, which proved effective in laboratory tests.

HOFFER (A.). *Aphytis proclia* (**Walker**) (**Hym. Chalcidoidea, Aphel.**). **Hlavní parasit červce San José na Slovensku.** (**První příspěvek k parasitaci červce San José na Slovensku.**) [*A. proclia*—the chief Parasite of the San José Scale in Slovenia. (First Contribution to the Parasites of the San José Scale in Slovenia.)]—*Ochr. Rost.* **21** pt. 5–6 pp. 44–52, 1 fig. Prague, 1948. (With Summaries in French and Russian.)

In view of the establishment of *Quadraspidiotus* (*Aspidiotus*) *perniciosus* (Comst.) on fruit trees in southern Slovakia [*cf. R.A.E.*, A **39** 423], investigations on its parasites there have been begun, and in this paper the author gives a detailed description of the adult of *Aphytis proclia* (Wlk,), which constituted 87 per cent. of the parasites reared from examples of the Coccid taken in a heavily infested district ; the percentage parasitism was variable, but ranged up to 60. The systematics of this Aphelinid are discussed, morphological characters distinguishing it from other European species of *Aphytis* are indicated, and its alternative hosts are enumerated.

PŘÍHODA (A.). *Miccotrogus picirostris* **Fabr., škůdce švédského jetele.** [*Tychius picirostris*, a Pest of Alsike Clover.]—*Ochr. Rost.* **21** pt. 5–6 pp. 58–61, 1 fig., 8 refs. Prague, 1948. (With a Summary in French.)

Tychius (*Miccotrogus*) *picirostris* (F.) is abundant and widely distributed in Czechoslovakia, where it causes considerable loss of seed of alsike clover (*Trifolium hybridum*). The eggs of this weevil are laid in the flower buds and have been

reported to hatch in 7–9 days. The larvae feed in the young pods for 11–18 days and then enter the soil and pupate close beneath the surface. There are two or three generations a year, winter being passed by the adults. The importance of *T. picirostris* in Czechoslovakia has hitherto been much underestimated, the damage caused by it being usually attributed to other weevils.

ŘEZÁČ (M.) & ZACHA (V.). **Potírání listové formy révokazu zimním postřikem. (Předběžné sdělení.)** [Control of the Leaf Form of *Phylloxera* by Winter Spraying. (Preliminary Communication.)]—*Ochr. Rost.* **21** pt. 5–6 pp. 75–77, 3 refs. Prague, 1948. (With a Summary in English.)

In recent years, the leaf form of *Phylloxera vitifoliae* (Fitch) (*vastatrix* Planch.) has spread on American grape vines grown for grafting stock in Moravia, and preliminary experiments were carried out in 1948 against the winter eggs, which occur in cracks in the bark of the stumps. The stumps were freed from surrounding soil and sprayed in April with 2 or 3 per cent. of a proprietary preparation of dinitro-o-cresol or 1 per cent. of it with 3 per cent. of a tar distillate (carbolineum). The percentages of vines showing galls on the leaves in September were 100, 15 and 0·1, respectively, as compared with 100 for no treatment.

GALLAY (R.). **Stations fédérales d'essais viticoles, arboricoles et de chimie agricole, à Lausanne et à Pully, sous-station en Valais, Conthey-Sion-Vétroz. Rapport d'activité 1948.**—*Landw. Jb. Schweiz* **63** pt. 8–9 pp. 767–904, 23 figs., refs. Berne, 1949.

This report contains a section (pp. 816–829) dealing with work on pests of vines and fruit trees in French Switzerland and the Ticino in 1948. In continuation of experiments on the control of *Clysiana* (*Clysia*) *ambiguella* (Hb.) and *Polychrosis botrana* (Schiff.) on grape vines [*cf. R.A.E.*, A **39** 202], sprays containing 0·008–0·1 per cent. parathion proved generally superior to suspensions or emulsified solutions of 0·1 per cent. DDT against the second generation, giving 87–100 per cent. control. Infestation was low on untreated plots. Parathion emulsion sprays applied against *Anthonomus pomorum* (L.) on apple were comparable in effect to BHC (benzene hexachloride), and both were inferior to DDT when the latter was applied at the green-tip stage [*cf.* **39** 203]. The three materials were about equally effective against *Hoplocampa* spp. on plum. There were again considerable outbreaks of *H. brevis* (Klug) on pear in the Ticino, where averages of 38·2–102·7 eggs per 100 flowers were recorded in March. Owing, however, to high mortality of eggs and first-instar larvae, the percentages of infested fruits in May were only 16–31·4 on untreated trees. Sprays of BHC and parathion applied in late March or early April gave practically complete control, and were more effective than a DDT emulsion spray.

In dormant sprays against leaf pests, in particular *Hyponomeuta padellus* (L.) on plum and *Chloroclystis rectangulata* (L.), *Argyresthia cornella* (F.) and *Operophtera brumata* (L.) on apple, combinations of white oil and DNC (dinitro-o-cresol) were as effective as DNC alone or with tar distillates (carbolineum). Parathion applied alone in sprays against *Cydia* (*Laspeyresia*) *pomonella* (L.) on apple and apricot gave unsatisfactory results, but mixtures of DDT, parathion and wettable sulphur gave good control of *C. pomonella* on apple and also of the red spider [*Paratetranychus pilosus* (C. & F.)] and the woolly aphis [*Eriosoma lanigerum* (Hsm.)]. Melolonthid larvae attacking the roots of trees in an orchard in Valais were greatly reduced in number by injecting suspensions and particularly emulsified solutions of BHC into the soil round the trunks. The campaign to prevent the establishment of *Quadraspidiotus perniciosus* (Comst.) [*cf.* **39** 204, etc.] was continued.

Sylvén (E.). **Skidgallmyggan,** *Dasyneura brassicae* **Winn.** [The Bladder Pod Midge, *D. brassicae*.]—*Medd. Växtskyddsanst.* no. 54, 120 pp., 36 figs., 61 refs. Stockholm, 1949. (With a Summary in English pp. 101–117.)

With the increase in the cultivation of rape and other oilseed-producing crucifers in southern Sweden since 1941, there has in many districts been an increase in infestation of the pods by *Dasyneura brassicae* (Winn.) [*cf. R.A.E.*, A **32** 105 ; **39** 358]. All stages of this Cecidomyiid are described, its food-plants and world distribution are reviewed, and a detailed account is given of investigations on its bionomics, frequency and control in Sweden in 1946–48. The following is based largely on the author's summary of the results.

The cultivation of rape in southern Sweden is mainly restricted to two large groups of districts, a southern one and one more to the north ; their situation is shown on maps. *D. brassicae* was present throughout the southern area, but absent from the more northerly one, having apparently been unable to cross the intervening zone, in which plants suitable for the development of the first generation of the year are rare. The females lay their eggs in holes in the pods, chiefly those made by the females of *Ceuthorrhynchus assimilis* (Payk.) when they oviposit or gnaw the pods to feed. In the laboratory, holes made by *C. quadridens* (Panz.) were similarly used, but this weevil is not common on pods in the field. Eggs are seldom laid in mature pods, of which the walls become dry and hard. The eggs are laid singly or in groups, several females sometimes using the same hole, and hatch in about four days. The larvae feed mainly on the inner surface of the wall and also attack the seeds. They do not usually spread in the pod beyond the chamber in which the eggs were laid. Infested pods become swollen and stunted and open prematurely. Infestation by *D. brassicae* frequently results in the death of the larvae of *C. assimilis*, which develop more slowly and are affected by the premature opening of the pods. Larvae of *D. brassicae* leave the pods 14–15 days after the eggs were laid and pupate in cocoons just below the surface of the soil. The adults emerge 13–33 days after the larvae have left the plant, and the pupal stage lasted 5–7 days in the laboratory. The parasites, *Ceraphron* (*Calliceras*) *tenuicornis* (Thoms.), *Secodes clypealis* (Thoms.), *Prosactogaster* sp., *Synopeas* sp. and *Tetrastichus* sp. were reared from cocoons of the gall-midge.

Winter is passed chiefly by the full-fed larvae in the soil, and observations by means of emergence boxes showed that there are at least three generations a year. Winter rape is infested by the first and second generations, and summer rape by the second and third. The distribution of infestation within a field and the incidence of attack throughout the infested area are discussed. If attack is low, it is usually concentrated at the edges of a field, and attack is usually less in exposed areas. The percentages of pods damaged in Skåne were about 12·2 and 12·7 for winter and summer rape, respectively, in 1946, 26 and 1·9 in 1947, and 3·6 and 2·8 in 1948. The total loss in weight of seed from damaged pods of winter rape was about 82 per cent., and since much seed from damaged pods is lost during harvesting, the yield from a heavily infested field is seldom more than 5–10 per cent. of normal. If infestation is light or moderate, there is some compensation owing to increased weight of sound pods.

For control of *D. brassicae*, it is recommended that the fields should be situated in places exposed to the wind and should be as large as possible, so as to concentrate the crop. If there is heavy winter killing of rape in a district in which infestation was heavy in the previous year, the remaining plants should be ploughed under in early spring. The cultivation of winter rape in certain districts should be avoided every third year. It is thought that late planting should reduce infestation of summer rape. As attack by *D. brassicae* is dependent on that by *C. assimilis*, insecticides might be used against the weevil alone, against the weevil and the gall-midge, or against the gall-midge

alone. In tests, a dust of 4 per cent. DDT (75–80 per cent. p,p′ DDT) and 12 per cent. benzene hexachloride (13 per cent. γ isomer) applied before flowering against *C. assimilis* was effective against the weevil but did not consistently reduce infestation by the gall-midge. Treatment against both pests together has to be applied while the rape is in flower and might therefore be harmful to honey bees. In a test, two applications of the dust considerably reduced the numbers of both the weevil and the gall-midge, but there was no significant increase in the amounts of seed harvested. The third method is considered undesirable, since it might result in an increase in infestation by the weevil, which is to some extent controlled by *D. brassicae*. It was therefore not tested, but both it and the second method should be investigated further.

TRÄGÅRDH (I.). **Inomhus förekommande virkesförstörande insekter samt medlen att bekämpa desamma.** [Wood-destroying Insects that occur in Buildings and their Control.]—*Publ. K. Byggnadsstyr.* 1949 no. 1, 49 pp., 31 figs., 14 refs. Stockholm, 1950.

In this booklet, the author reviews the results of the survey of wood-destroying insects in public buildings in Sweden [*cf. R.A.E.*, A **35** 294, etc.] and gives notes on the appearance and habits of the main insects concerned (various beetles and *Sirex*), a key to them based on the size and shape of the emergence holes, etc., and a short discussion of the possible means of preventing and controlling infestation.

ANDER (K.). *Paralispa gularis* **Zell. (Lep. Pyr.), en för Sverige ny förrådsskadeinsekt.** [*Aphomia gularis*, a stored-product Pest new to Sweden.]—*Opusc. ent.* **16** pt. 1–2 p. 64. Lund, 1951. (With a Summary in German.)

Larvae of *Aphomia* (*Paralispa*) *gularis* (Zell.) were found together with those of the cacao moth, *Ephestia* [*elutella* (Hb.)], damaging almonds and other nuts in a confectionery factory in Malmö in 1950. The species was previously unknown in Sweden. Its feeding habits are briefly described [*cf. R.A.E.*, A **27** 520, etc.].

[KOZHANCHIKOV (I.).] **Кожанчиков (И.). The Significance of seasonal Changes in the Leaves of its Food-plants for the Development of the Gipsy Moth** (*Ocneria dispar* **L.).** [*In Russian.*]—*Dokl. Akad. Nauk SSSR* (N.S.) **66** no. 6 pp. 1203–1206, 2 graphs, 6 refs. Moscow, 1949.

Among Lepidoptera that develop on the leaves of trees in the Soviet Union, some, such as *Lymantria* (*Ocneria*) *dispar* L., give rise to larvae in spring and produce only one generation a year, whereas others of which the larvae do not appear until the summer produce several generations. Experiments with *L. dispar* are described showing that monovoltinism may in that species be partly due to the food requirements of the larvae, young leaves, which are rich in albumen, being essential for normal development.

Larvae of *L. dispar* that hatched in the laboratory in spring (May or June), summer (late June to mid-August) or autumn (mid-August to mid-October) were kept in darkness at optimum temperature and given leaves of willow (*Salix caprea*), oak (*Quercus robur*) or *Sorbus aucuparia* as food. The mortality percentages on willow were 6·5, 12·1 and 88 at the three seasons, respectively, and those on oak were also low in spring but rose to 68·3 and 98 in summer and autumn. No development occurred on *Sorbus* except on the earliest leaflets in spring, when mortality was 17·1 per cent. The duration of the larval stage was about the same on willow at all seasons, but the pupae were heaviest

in spring. Development was delayed on oak in autumn, and the average weight of the female pupae was increased, probably owing to the elimination of the weaker individuals. Pupal weight was unusually low on *Sorbus*. There were few differences in length of life or fecundity among females from larvae reared on willow, low fecundity among those from larvae on *Sorbus*, and increases in both length of life and fecundity among females from larvae reared on oak in autumn as compared with summer.

In similar experiments with *Malacosoma neustria* L., development was completed on spring foliage only, all the larvae dying in the first instar in the summer.

[Peredel'skiĭ (A. A.).] **Передельский (А. А.). The Bases of a new Method of Forecasting the Abundance of Cereal Bugs by the Injury to the Grain.** [*In Russian.*]—*Dokl. Akad. Nauk SSSR* (N.S.) **67** no. 2 pp. 385–388, 11 refs. Moscow, 1949.

The grains of cereals grown in the Soviet Union are attacked by Pentatomids of the genera *Eurygaster*, *Aelia*, *Dolycoris* and *Carpocoris*, but only those that reduce the content of gluten are important [*cf. R.A.E.*, A **31** 38; **32** 160]. In this paper, the author describes a method of forecasting the occurrence of injury by calculating the percentage of grains punctured in the autumn and analysing the gluten content to see whether the injurious species are present. This method is simpler than that of examining the organs of the bugs during hibernation [*cf.* **35** 345], though it may not give such reliable results; forecasts made by any method may be falsified by mass migrations of the bugs.

[Geĭspitz (K. F.).] **Гейспиц (К. ф.). Light as a Factor regulating the Cycle of Development of the Pine Lasiocampid,** *Dendrolimus pini* **L.** [*In Russian.*] —*Dokl. Akad. Nauk SSSR* (N. S.) **68** no. 4 pp. 781–784, 1 graph, 8 refs. Moscow, 1949.

In the Soviet Union, *Dendrolimus pini* (L.) (pine Lasiocampid) overwinters in the larval stage and usually completes its life-cycle in one year in the southern regions of its distribution, whereas the larvae hibernate twice in the northern ones [*cf. R.A.E.*, A **23** 259]. Since feeding ceases before the cold weather sets in, it was thought that a diapause was involved, and experiments were carried out in 1948 to determine whether its occurrence was affected by light. Larvae were obtained from eggs collected near Leningrad, and several generations were reared on pine at 19–20°C. [66·2–68°F.] under electric light of an intensity of 60 lux. Some larvae were kept under conditions of nine hours' illumination per day from hatching, some were transferred from constant illumination to these conditions in the first, third, fourth or fifth instar, and some were kept under constant illumination throughout. Those in the first group entered diapause in the second instar, and those in the next four in the third, fourth, fifth and sixth, respectively, whereas larvae in the last group developed without diapause. Diapause was thus not connected with any particular instar. It usually began 30–31 days after the beginning of exposure to the short day. Its duration showed great individual variations and ranged at 20°C. from an average of 14 days for second-instar larvae to 26 days for those in the sixth instar; the loss in weight during diapause averaged 12–14 per cent. in all series.

In experiments on the effect of light on the termination of diapause, fifth-instar larvae that had been in diapause for 2–3 days under 9-hour conditions of light were transferred to constant illumination. Diapause ceased after a further 14–15 days and subsequent development was markedly stimulated, pupation taking place at about the middle of March. Control larvae that

remained under the 9-hour conditions stayed in diapause for 26 days, and their further development was slow and uneven, some not being full-fed by the beginning of May.

In further tests, larvae that were kept under the 9-hour conditions and entered diapause in the third instar were transferred to constant illumination after the completion of the diapause and then back to the 9-hour conditions in the fifth instar, after which they again entered diapause in the sixth instar. In both cases, the diapause began 30 days after exposure to the short day. Conditions of illumination during the larval stage affected the duration of the pupal stage, which averaged 18·2 days for individuals reared under the 9-hour conditions and 12·8 days for those reared under constant illumination.

It is concluded that light is an important factor in the development of *D. pini* and that since the diapause can be shifted from one larval instar to another and brought to an end by suitable illumination, it differs little from winter dormancy.

[Komarova (O.S.).] **Комарова (О. С.). Causes that bring about the Diapause of the Grape-vine Leaf-roller (*Polychrosis botrana* Schiff.).** [*In Russian.*]—*Dokl. Akad. Nauk SSSR* (N. S.) **68** no. 4 pp. 789–792, 1 graph, 7 refs. Moscow, 1949.

In the region of Kirovabad, Russian Azerbaijan, *Polychrosis botrana* (Schiff.) has three generations a year on grape vine, the larvae feeding on the inflorescences and the unripe and ripe grapes, respectively. In view of the importance of the pupal diapause for the composition of the overwintering population, its occurrence was studied in 1947 and 1948 at Kirovabad and at Khanlar, a place in the foothills about 5 miles distant, where temperatures are somewhat lower. At both places, no pupae of the first generation and all those of the third entered diapause, while the percentages of the second generation that diapaused were 1·8 and 0 in the two years at Kirovabad and 75·6 and 39·9 at Khanlar.

Experiments were therefore carried out to ascertain the reason for the divergent behaviour of the second generation. It was found not to be due to temperature, humidity or food, and as the first diapausing pupae occurred at both places at the beginning of August, attention was directed to effects of light. In experiments in June–July at 25–30°C. [77–86°F.] examples of the second generation were reared under different daily exposures to light and the effect on pupal diapause noted. No diapause occurred under normal light conditions (over 15 hours per day in July) and none when larvae in any instar were transferred to continuous darkness, but transfer to darkness in the egg stage led to 66·7 per cent. diapausing pupae. A reduction in the number of hours of light per day to 12, 10 and 8 resulted in 100 per cent. diapausing pupae when it took place in the egg stage, 23·1, 9·1 and 0 per cent. in the first larval instar, 13·3, 6·2 and 12·5 in the second, 5·5, 0 and 0 in the third, and 0 in the fourth. It thus appeared that diapause resulted from a reduction of exposure to light in the early stages of growth. Eggs and larvae of the second generation are present later in the year at Khanlar than at Kirovabad, owing to the lower temperatures, and development at both places was accelerated in 1948, which was a hot year, compared with 1947. It is concluded that these differences are responsible for the variation in diapause, since they result in exposure to different conditions of light.

Simmonds (F. J.). **The Biology of Parasites of *Loxostege sticticalis* L. in North America. IV. *Cryptus inornatus* Pratt (Ichneumonidae, Cryptinae).**—*Proc. R. ent. Soc. Lond.* (A) **23** pt. 7–9 pp. 71–79, 11 figs., 7 refs. London, 1948.

During investigations on the parasites of *Loxostege sticticalis* (L.) in Canada and the United States made in connection with work on the biological control of *L. frustalis* (Zell.) in South Africa [*R.A.E.*, A **35** 294; **36** 28; **39** 88],

Cryptus inornatus Pratt and an undescribed species of *Cryptus* were the only parasites found to attack the host in the cocoon. This paper contains information on the bionomics of *C. inornatus* [*cf.* **38** 397], with descriptions of the immature stages and of the techniques adopted for rearing and a discussion of the potential value of this Ichneumonid against *L. frustalis*. It appears to be widely distributed in Montana and Alberta. When fully developed overwintering larvae in their cocoons, which are formed within those of the host, were brought from the field into the higher temperatures of the laboratory, some completed their development in a short time, whereas others remained in diapause [**34** 295] ; by this means, the period during which the hosts are liable to attack is extended, since some parasite adults emerge during warm weather in autumn and early spring and attack overwintering host larvae, and adults from larvae that diapause are available later in the spring. The males, which predominate somewhat in field collections, emerge about a day earlier than the females and, unlike them, pair readily when several days old. Unfertilised eggs give rise to male progeny. The eggs are laid in the host cocoon near the host larva, which is first paralysed, and super-parasitism is common, even when hosts are abundant [**38** 397] ; host larvae are sometimes paralysed without eggs being deposited. At 75°F., the eggs hatched in 1–2 days, and the larvae, which feed ectoparasitically, spin their cocoons after about five days. The prepupal stage of both diapausing and non-diapausing larvae lasted 1–2 days, and the pupal stage 5–6. When females had access to cane sugar, raisins or both in addition to honey and water, they laid averages of 27·1, 113·1 and 90·7 eggs each, 30·6, 44·3 and 48·1 per cent. of the eggs died, and the percentages of larvae that entered diapause were 2·5, 29 and 36·5, respectively.

In the rearing technique adopted for experimental work, the eggs laid by isolated females, each offered five fresh host cocoons daily, were transferred to individual paralysed hosts (or larvae killed by coddling in water at 120°F. for two minutes) in shell vials, in which the parasite larvae were allowed to develop until they were nearly full grown, when they were again transferred, each with its host, to gelatin capsules in which they spun their cocoons. In the method finally adopted for mass rearing, 50–100 fertilised females were placed in a large cage with the number of cocoons found by sampling to be consistent with the least wastage of hosts and parasite eggs ; the cocoons were removed daily and kept at 75°F. for six days, when the parasite larvae, then nearly fully grown, were transferred, each with a host, to individual gelatin capsules. Some 12,000 cocoons were obtained by this method and shipped to South Africa to provide breeding stock and material for liberation against *L. frustalis* [**38** 397].

The percentage parasitism of *L. sticticalis* by *C. inornatus* in autumn was only 0·12 in Montana in 1941 and 0·04 and 1·73 in Alberta in 1942 and 1945, but these figures are probably not indicative of its true value, since the parasite was still active when the cocoons were collected in 1945, and the overwintering population would be subject to further attack in the spring. The spring attack may not take place until after parasites that attack the larvae earlier have emerged, thus reducing the risk of multiparasitism ; *C. inornatus* has been bred from hosts from which fully developed larvae of *Meteorus loxostegei* Vier. have already emerged, and there is no indication that the ovipositing females avoid host larvae that contain the immature stages of other species.

Berck (B.) & Smallman (B. N.). **Loss of DDT Residues in Box Cars carrying Flour.**—*Cereal Chem.* **28** no. 4 pp. 317–324, 1 fig., 7 refs. Lancaster, Pa., 1951.

Railway box cars used for transporting cereal products may harbour insects injurious to their contents, and the application of DDT has been advised for

control. However, flour sent by rail in Canada may be in transit for 12 days, during which time, DDT applied to the floors and walls of the cars would be subject to abrasion by the load, to shock and vibration and possibly to high temperature and humidity, all of which might alter the original deposit by dislodging part of it or by promoting chemical degradation. Such changes would be modified by position in the box car and the form in which the insecticide was applied. Investigations were therefore made to determine the losses from deposits of DDT applied at about 125 mg. per sq. ft. in 5 per cent. oil solution, water emulsion or water suspension to pieces of plywood, which were then attached to the floors and walls of box cars carrying sacks of flour from Winnipeg to Montreal, or in 5 per cent. oil solution to the paper used to line such cars. The mean losses from deposits situated on the end walls above the load, on the side walls in contact with the load and on the floors, respectively, were 32·4, 39·5 and 43·2 per cent. for DDT in water suspension, 16·7, 24·4 and 28·2 per cent. for DDT in oil solution and 13·7, 25·5 and 22·9 per cent. for DDT in water emulsion on wood, and 5·1, 10·9 and 15·3 per cent. for DDT in oil on paper. Dislodgement by shock or vibration, thermal decomposition or both might have accounted for the relatively high losses above the load. The superior retention of DDT on car-lining paper indicates a simple method for maintaining a maximum amount of the insecticide in position to protect the load during transit, and added protection could be obtained by covering the upper surface of the load also. On arrival, removal of the paper would effectively free the car from DDT residues. If the paper could be impregnated with DDT at the paper mill, the cost would be much less than that of spraying the cars individually.

Car surfaces directly sprayed with DDT might contaminate subsequent loads, such as bulk grain, and as it has recently been shown that DDT may be transferred, partly as vapour, from impregnated cotton sacks to enclosed flour, the flour load itself might become contaminated during transit in wagons sprayed with DDT or lined with impregnated paper.

WESTDAL (P. H.). **A preliminary Report on the Biology of *Phalonia hospes* Wlshm. (Lepidoptera : Phaloniidae), a new Pest of Sunflowers in Manitoba.** —*80th Rep. ent. Soc. Ont. 1949* pp. 36–38. Toronto, 1950.

Sunflowers [*Helianthus*] have been grown in Manitoba for about 50 years, but were not cultivated on a commercial scale until 1943, when war-time conditions created a need for oil-bearing seeds. By 1949, the area under cultivation had increased to 60,000 acres. The crop is attacked by *Phalonia hospes* (Wlsm.), all stages of which are briefly described, and an unidentified species of *Phalonia* closely allied to *P. lavana* Busck, which was first reported in 1944. Loss of seed caused by these moths averaged 1·7 and 3·5 per cent. in 1948 and 1949, respectively, and was as high as 40 per cent. in the latter year in some fields.

Observations on the bionomics of *P. hospes* were made during 1948 and 1949. They showed that eggs are deposited singly on the bracts of flower heads that are about to open and are most numerous on the outer ones ; under cage conditions, some were also laid on the upper leaves. The larvae hatched in 5–8 days and entered the open florets, where they at first fed on the pollen ; those that hatch when pollen is not available fail to become established. On reaching the third instar, the larvae entered the seeds and fed on the contents, later moving to other seeds. There are five instars, and the first four lasted about three weeks. Between late August and the end of September, the larvae entered the soil, where they overwintered in cocoons at a depth of about 2 ins. ; pupation took place in late June in the cocoon or in the surrounding

soil. Under laboratory conditions the pupal stage lasted about 12 days. The adults emerged in early July, and emergence in cages continued until 26th August. Oviposition began about 15th July, and no eggs were found in the field after 25th August, though adults remained active until the end of that month. Larvae in all stages of development are present in each field, though those in the individual inflorescences are of about the same age. Late flowering heads, which are usually small, are often severely infested.

WINKLER (A. J.). Ed. **Pierce's Disease Investigations.**—*Hilgardia* **19** no. 7 pp. 207–264, 11 figs., 21 refs. Berkeley, Calif., 1949.

Pierce's disease of grape vines caused serious losses in the vineyards of southern California in 1880–1900, and a second outbreak, which affected mainly the San Joaquin Valley, developed about 1935 and lasted until about 1945. The disease is caused by a virus that has been shown to infect plants of 20 families, including grasses, and also causes dwarf disease of lucerne. The symptoms in vines, which are described, vary with variety and locality and include drying of the leaves, dwarfing, gradual dying of the root system, and the death of the vine, which occurs in from three months to 4–5 years. They are apparently the result of gum formation in the wood and subsequent excessive development of tyloses (growth of cells into the water-conducting vessels). Outbreaks have been closely correlated with increases in rainfall.

The virus has been transmitted experimentally from diseased to healthy vines by grafting and by insect vectors. The latter, of which lists are given, comprise 14 species of Jassids [*cf. R.A.E.*, A **40** 31, etc.] and four species of Cercopids, including six colour varieties of *Phitaenus leucophthalmus* (L.) [*cf.* next abstract]. Of all these, only the Jassids, *Carneocephala fulgida* Nott., *Hordnia* (*Neokolla*) *circellata* (Baker) and *Draeculacephala minerva* Ball, are important in actually spreading the virus in vineyards and lucerne fields. The other insects rarely occur there, but may spread the virus in its wild host-plants and so maintain a reservoir in these throughout the State. Notes are given on the life-history, distribution, food-plants, feeding habits and flight of the three important species, with descriptions of their mode of feeding and of transmitting the virus ; feeding in the xylem appeared necessary for transmission. *H. circellata* is the only one that breeds on vines ; the other two breed mainly on grasses.

Investigations on the control of the disease are described in detail. The removal of diseased vines at least twice each year did not significantly influence the occurrence of new infections, but the practice of removing diseased vines at least once a year and replanting with healthy stock kept the vineyards in production. Roguing experiments indicated that the diseased vines were not the principal source of virus, which generally spread to vineyards from outside sources, and the occurrence of new infections was not influenced by cultivation or the application of oil sprays to control weeds. The averages of samples of Jassid populations in areas of 2·5 acres and their yearly trends were correlated with the percentages of vines that developed the disease. Cutting the shoots to 36 ins. above the ground at midsummer (which injured the vines and reduced the crop), keeping them at this height and keeping all the shoots on top of a 7-ft. arbour did not prevent infection.

The Jassids might be controlled in vineyards, lucerne fields, irrigated pastures and other breeding areas by means of insecticides, but each of those tested in the field (DDT, calcium-cyanide dust and pyrethrum) had limitations to practical and economical use. No effective programme of seasonal control has been developed, and there is no evidence to indicate that such a programme would give appreciable control of the disease.

DeLong (D. M.) & Severin (H. H. P.). **Spittle-insect Vectors of Pierce's Disease Virus. I. Characters, Distribution, and Food Plants.**—*Hilgardia* **19** no. 11 pp. 339–356, 4 col. pls., 4 figs., 5 refs. Berkeley, Calif., 1950.

Severin (H. H. P.). **II. Life History and Virus Transmission.**—*T.c.* pp. 357–376, 6 pls. (2 col.), 27 refs.

The following is based on the authors' summaries. In the first part, descriptions are given of the distinguishing characters, especially the genitalia, of the Cercopids, *Aphrophora angulata* Ball, *A. permutata* Uhl., *Clastoptera brunnea* Ball and *Philaenus leucophthalmus* (L.), together with notes on their distribution and lists of their food-plants in California. Distinctive markings are described and illustrated for six named colour varieties of *P. leucophthalmus* that occur in California, of which one is new.

In the second, the author gives notes on the bionomics of the four species and states that *A. permutata* and *C. brunnea* have two generations a year and *P. leucophthalmus* one under natural conditions in California. All four species, including the five varieties of *P. leucophthalmus* that were tested, transmitted the virus that causes Pierce's disease of grape vines from diseased to healthy vines in single-insect tests, with efficiencies ranging from 12 per cent. for *C. brunnea* to 65 per cent. for *P. leucophthalmus* var. *leucophthalmus*. The two species of *Aphrophora* and several varieties of *P. leucophthalmus* occasionally transmitted the virus from vines to lucerne and from lucerne to vines, but *C. brunnea* did not, and only *P. leucophthalmus* transmitted it from diseased to healthy lucerne. Two varieties of *P. leucophthalmus* were the only ones of these insects to be found naturally infected. Grape vines were an unfavourable food-plant for all but *P. leucophthalmus*, and lucerne was unfavourable for *C. brunnea*. None of the Cercopid vectors was collected on grape vine or in lucerne fields in California, though *P. leucophthalmus* was once collected on self-sown lucerne among weeds, and none seems to be of economic importance in spreading the virus under natural conditions in California [*cf.* also preceding abstract], except that *P. leucophthalmus* may infect perennials that serve as reservoirs of the virus. The minimum latent period of the virus in adults of four varieties of *P. leucophthalmus* was 2–7 hours, and the virus was retained for 29–76 days.

Chamberlain (W. F.) & Hoskins (W. M.). **The Toxicity and Repellence of organic Chemicals toward Termites, and their Use in Termite-proofing Food Packages.**—*Hilgardia* **19** no. 9 pp. 285–307, 3 figs., 16 refs. Berkeley, Calif., 1949.

In the course of investigations on the protection of packed foods from insects, a method was developed for testing the toxic and repellent effects of chemicals on insects by confining them in a circular arena over treated paper or cardboard. Several arrangements of treated and untreated areas were used, and the results were expressed in terms of the distribution of the insects on the areas and the length of time before they penetrated the floor of the arena.

In preliminary tests with various materials commonly used for wrapping, the dampwood termites, *Zootermopsis angusticollis* (Hagen) and *Z. nevadensis* (Hagen), penetrated kraft paper and cellophane at least as rapidly as larvae of *Tenebroides mauritanicus* (L.) and cellophane much more rapidly than larvae of *Tenebrio molitor* L. and adults of *Calandra* (*Sitophilus*) *granaria* (L.). As the termites showed marked similarity in rate of penetration, they were used interchangeably in later experiments. When kraft paper was soaked in 1 or 2 per cent. solutions of copper sulphate, 2,4,5-trichlorophenol, o-chlorohydroquinone, BHC (benzene hexachloride), DDT, o-iodonitrobenzene, terpineol, benzil,

quinoline, dinitro-o-cresol, copper dinitro-o-cresylate, morpholine dinitro-o-cresylate, diphenylamine dinitro-o-cresylate, phenothiazine dinitro-o-cresylate, dinitro-o-cresylacetate, dinitro-o-cresyltrichloroacetate, thiocyanates (β,β′-dithiocyanodiethyl ether and β-butoxy-β′-thiocyanodiethyl ether), and coumarin and allowed to dry, it was repellent to the termites. Thiocoumarin was strongly repellent at first, but soon evaporated. Various relatively non-volatile essential oils were not noticeably repellent. When the most effective chemicals were dissolved in wax and the paper treated by dipping, 3·3 per cent. BHC (30 per cent. γ isomer), 5 and 2 per cent. DDT and 2 per cent. dinitro-o-cresol, phenothiazine dinitro-o-cresylate or dinitro-o-cresylacetate prevented penetration for more than six months, and chlordan gave promising results in preliminary tests.

Toxicity was associated with repellency in some but not all materials, chlorohydroquinone, iodonitrobenzene, quinoline, thiocoumarin, benzil and terpineol showing repellency but little toxicity, and BHC, DDT at the higher concentrations, the dinitro compounds, the thiocyanates and coumarin both repellency and marked toxicity. BHC protected cardboard boxes for more than 18 months when used at 1 per cent. γ isomer in wax, but its objectionable odour makes its use near food scarcely possible. The dinitro compounds stain everything near them a strong yellow, so that it is doubtful if they could be used on food packages, and DDT decomposes to some extent in hot wax, so that it should not be used at less than 5 per cent.

THOMPSON (C. G.) & STEINHAUS (E. A.). **Further Tests using a Polyhedrosis Virus to Control the Alfalfa Caterpillar.**—*Hilgardia* **19** no. 14 pp. 411–445, 14 figs., 8 refs. Berkeley, Calif., 1950.

The following is taken mainly from the authors' summary. The results are given of laboratory and field observations and tests in 1947–49 on the control of *Colias eurytheme* Boisd. on lucerne in California by dissemination of the virus (*Borrelina campeoles* of Steinhaus) that causes polyhedral disease of that Pierid [*cf. R.A.E.*, A **38** 201 ; **39** 318]. From these it was concluded that natural epizootics do not occur regularly enough to give satisfactory economic control and probably cannot be induced by cultural practices ; that the virus can be transmitted mechanically by contaminated adults of *Colias* or of the parasite, *Apanteles medicaginis* Mues., carnivorous insects, wind, rain and irrigation water ; and that passage of the virus by way of the egg apparently occurs by external contamination. Temperature appeared to have little effect on the susceptibility of the insect to infection, but within the temperature ranges tolerated by the caterpillar, the incubation period of the virus decreased as the temperature rose. Relative humidity appeared to have little effect on either the susceptibility of the host or the incubation period of the disease, but both this and temperature affected the population density of the host. The application of a virus suspension containing five million polyhedra per ml. at the rate of 5 U.S. gals. per acre by aeroplane or ground machine appeared adequate to ensure infection of a field population and its reduction to below economic levels under the conditions usually encountered in the northern San Joaquin Valley.

DELONG (D. M.) & SEVERIN (H. H. P.). *Texananus incurvatus*. **I. Taxonomy.**—*Hilgardia* **19** no. 18 pp. 541–543, 1 col. pl., 1 fig., 3 refs. Berkeley, Calif., 1950.

SEVERIN (H. H. P.). **II. Transmission of California Aster-yellows Virus.**—*T.c.* pp. 544–545, 2 refs. **III. Life History on virus-infected and on healthy Plants.**—*T.c.* pp. 546–548, 3 refs.

Experiments are recorded in the second of these papers, showing that *Texananus incurvatus* (Osb. & Lathr.), like six other Jassids related to it

[*R.A.E.*, A **37** 143], transmitted the virus of California aster-yellows in the laboratory. Single adults transmitted it from celery to 22 per cent. of healthy celery plants and 1 per cent. of healthy asters, and the virus was retained in the insects for 11–44 days.

The first contains descriptions and illustrations of the adults of *T. incurvatus*, with special reference to the male genitalia, and a note on its geographical distribution, which comprises parts of Arizona, California and north-western Mexico, and the third the results of experiments showing that the durations of the nymphal stage on healthy and infected celery did not differ significantly, but that mortality of nymphs was high on healthy plants and negligible on infected ones.

SEVERIN (H. H. P.) & KLOSTERMEYER (E. C.). *Colladonus geminatus* **and** *C. montanus*. **Life Histories on virus-infected and on healthy Plants.**—*Hilgardia* **19** no. 18 pp. 553–560, 2 col. pls., 3 refs. Berkeley, Calif., 1950.

The following is virtually the authors' summary. Comparative life-history studies of *Colladonus geminatus* (Van Duzee) and *C. montanus* (Van Duzee), which were selected because they undergo no nymphal mortality on either healthy celery plants or those infected with California aster-yellows [*cf. R.A.E.*, A **37** 145], showed no significant differences in duration of nymphal stages between individuals reared on healthy celery and those reared on diseased celery. The total duration of the nymphal stage was shorter for males of *C. montanus* than for the females. The two species did not interbreed.

JONES (L. G.), BRIGGS (F. N.) & BLANCHARD (R. A.). **Inheritance of Resistance to the Pea Aphid in Alfalfa Hybrids.**—*Hilgardia* **20** no. 2 pp. 9–17, 1 fig., 7 refs. Berkeley, Calif., 1950.

The following is almost entirely the authors' summary. *Macrosiphum pisum* (Harris) (*pisi* (Kalt.)) causes varying amounts of damage to lucerne in the United States, and injury has often been severe in the Antelope Valley of California. Undamaged lucerne plants collected in this valley proved to be heterozygous for resistance, and a homozygous resistant plant derived from one of them was crossed with a susceptible plant, and the inheritance of resistance studied in the F_2 and F_3 generations. It was found that resistance resulted from a dominant and a recessive gene and that they were linked, with a crossover value of 28 per cent. indicated. Satisfactory progress was made in breeding a lucerne of the Common Chilean type that was resistant to the Aphid.

SEVERIN (H. H. P.) & TOMPKINS (C. M.). **Symptoms induced by some Species of Aphids feeding on Ferns.**—*Hilgardia* **20** no. 5 pp. 81–86, 6 pls., 8 refs. Berkeley, Calif., 1950.

The following is based on the authors' summary. The Aphids, *Idiopterus nephrolepidis* Davis, *Macrosiphum pteridis* Wilson, *Myzus circumflexus* (Buckt.) and *M. solani* (Kalt.) were collected on maidenhair ferns (*Adiantum concinnum* and *A. cuneatum* var. *croweanum*) in greenhouses in the San Francisco Bay area of California. Symptoms produced by the feeding of *M. solani* on fronds of *Asplenium nidus* and *Cyrtomium falcatum* and of *I. nephrolepidis* on *A. nidus* are described. In the last two instances, when all the infested fronds were cut off, the symptoms appeared on the newly developing fronds, indicating a systemic effect. No symptoms developed when *Macrosiphum pteridis* or *Myzus circumflexus* fed on *A. nidus* or when the fronds of healthy plants were inoculated by the carborundum method with extract from affected fronds of *A. nidus* or examples of *M. solani* crushed in water.

SEVERIN (H. H. P.) & TOMPKINS (C. M.). **Aphid Transmission of Severe-mosaic Virus of Annual Stock.**—*Hilgardia* **20** no. 6 pp. 93–102, 4 pls., 8 refs. Berkeley, Calif., 1950.

Annual stock (*Matthiola incana* var. *annua*) in various parts of California is infected by two mosaic viruses that cause breaking in colour of the flowers, mild-mosaic virus [*cf. R.A.E.*, A **39** 450] and severe-mosaic virus, of which the latter also causes mottling and malformation of the leaves. In this paper, an account is given of laboratory studies on the transmission of the severe-mosaic virus by *Rhopalosiphum pseudobrassicae* (Davis), which breeds on the plant under natural conditions, and *Brevicoryne brassicae* (L.) and *Myzus persicae* (Sulz.), which do not.

When Aphids of these three species were reared on infected stocks and transferred singly to healthy ones, they infected 6, 3 and 0 per cent. of them, respectively, and when non-infective Aphids were starved for 2–3 hours, allowed to feed on infected stocks for 0·5–10 minutes and then transferred to healthy ones, they infected 12, 0 and 42 per cent. None of the three species infected cauliflower. Daily transfers of Aphids reared on infected stocks to successive healthy plants showed that none retained the virus for more than one day, and hourly transfers that *M. persicae* retained it for two hours and *R. pseudobrassicae* for one. Aphids of these two species that had been starved and then allowed to feed on infected plants for 5–10 minutes retained the virus for only ten minutes, and examples of *R. pseudobrassicae* that had become non-infective after infecting plants recovered the virus from the original infected plants before these showed symptoms. It is concluded that the virus is of the non-persistent type [*cf.* **29** 26]. Mechanical inoculation resulted in 51·4 per cent. infection.

PAPERS NOTICED BY TITLE ONLY.

SÉGUY (E.). **Un Chloropide (Dipt.) nouveau nuisible au riz** [*Elachiptera orizae*, sp. n., in southern France].—*Bull. Soc. ent. Fr.* **54** no. 2 pp. 23–24. Paris, 1949.

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